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PILOT SMALL BUSINESS TECHNOLOGY TRANSFER (STTR) PROGRAM AND SMALL BUSINESS INNOVATION RESEARCH (SBIR) PROGRAM: ASSESSING THE RESULTS OF PUBLIC LAW 102-654, THE "SMALL BUSINESS RESEARCH AND DEVELOPMENT ENHANCEMENT ACT OF 1992"

Y 4. SM 1: 104-63

Pilot Small Business Technology Tra...

HEARING

BEFORE THE

COMMITTEE ON SMALL BUSINESS
HOUSE OF REPRESENTATIVES

ONE HUNDRED FOURTH CONGRESS

SECOND SESSION

WASHINGTON, DC, MARCH 6, 1996

Printed for the use of the Committee on Small Business

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WEDNESDAY, MARCH 6, 1996

House of Representatives,
Committee on Small Business,
Washington, DC.

The Committee met, pursuant to notice, at 10 a.m., in room 2359, Rayburn House Office Building, Hon. Peter G. Torkildsen presiding.

Chairman Torkildsen. The Committee on Small Business will come to order.

Today's hearing highlights two Federal Government high-technology programs which seek to utilize the tremendous creativity and flexibility of small business and to promote commercialization of innovation derived from Federal research and development. These programs are the Small Business Innovation Research Program, or "SBIR," established in 1982, and the Small Business Technology Transfer Program, or "STTR," a 3-year pilot program which began in 1994.

The SBIR and STTR Programs give small business an opportunity to compete for a small percentage of Federal agencies' R&D budgets. Both programs are highly competitive and reflect the high caliber proposals brought to the table by small entrepreneurial companies.

Under SBIR, firms which have completed phase II projects achieve a 24 percent rate of commercialization after 4 years. In the first 2 years of the STTR Program, more than 430 phase I awards have been made valued at $40.5 million and 22 phase II awards have been issued at $10.7 million.

To bring those numbers a little closer to home — my home, for example — in Massachusetts, 600 SBIR awards were made in 1994 alone for close to $89 million and 25 STTR awards for almost $2.5 million.

The two programs share a common three-stage process designed to enable small firms to identify and nurture promising innovation in the marketplace. The one way the programs differ is that a small business must collaborate with a nonprofit research institution such as a university or federally funded research and development center to be eligible for an STTR award.

Today's program will focus on the STTR Program, which unless reauthorized, will terminate on September 30 of this year. The Committee must ask a difficult question today. Whether there is continued need for both the STTR and SBIR Programs given their similarity? The hearing will also consider recommendations for making the programs more effective in attaining their goals.

We are fortunate to have with us five representatives from the small business community who have been involved in the SBIR and STTR Programs, as well as Mr. Daniel Hill, Assistant Administrator for Technology Programs at the SBA, and Mr. Victor Rezendes, Director of Energy and Science Issues of the GAO.

With that I will yield to my colleague and friend, Mr. Poshard, for any opening statement he may wish to make.

[Chairman Torkildsen's statement may be found in the appendix.]

Mr. POSHARD. Mr. Chairman, I thank you for yielding. If I may just take a moment before I give my opening statement. It is a great honor for me to introduce to our Committee again and to the folks here who are in our audience today a gentleman who is the founder or what we term the "father of the SBIR Program," Mr. Roland Tibits is with us here this morning.

Mr. Tibits founded this program with the National Science Foundation back in 1977. It has opened up, essentially, all Government R&D to small, high-technology firms, just has been a tremendously successful program, and we are deeply indebted and grateful to Mr. Tibits for the work that he has done with this program.

I would like to ask him, if it is OK, Mr. Chairman, to stand and be recognized by the Committee and the folks here in the room.

Chairman TORKILDSEN. The Chair joins everyone in applauding your significant contribution.

Mr. POSHARD. I should have said that Mrs. Tibits is with us here also. We certainly are thankful for her contribution.

Mr. Chairman, thank you for holding this hearing on the reauthorization of the Small Business Technology Transfer Program and the Small Business Innovation Research Program. By all accounts, these programs have fulfilled their missions of stimulating technological innovation. Their success has not just been a boon for small business, but for the entire American economy.

While it is too early to know the economic impact of STTR, the SBIR Program conceived in 1977 and begun in 1982 has generated billions of dollars in innovative development while also creating jobs by linking small businesses with research and development funds for Federal agencies. Ranking Member LaFalce deserves much credit along with Chairwoman Meyers for both of these programs, and I would like to thank them for their leadership.

As many of you know, the STTR Program is especially dear to me. In 1992, with the help of then-Chairman LaFalce and Subcommittee Chairman Skelton, I saw the need to supplement the already successful SBIR Program by tapping into the vast resources of innovation that exist at our universities and nonprofit institutions.

The United States has long been the world's research leader, but has been less successful in transforming discoveries into marketable products and permitting its top researchers the freedom to pursue commercial projects. The STTR Program was designed to fill this void by awarding funds to small businesses and researchers at universities and nonprofit institutions that allow them to work in concert. The SBIR Program has tended to fund our Nation's major research corridors in places like the Silicon Valley and around Route 128 in Massachusetts. The STTR Program has enabled the rest of the country to get involved. In 1994, 32 States and the District of Columbia were represented by research institutions in the STTR Program. In my State of Illinois, five research centers are participating including: Southern Illinois University, the University of Illinois, and Northwestern University. I might say also that when we were developing this program, there was a young man working on the Committee, who has now moved over to the Department of Defense, Jon Baron.

Jon, raise your hand.

Jon was a young man who followed in the footsteps of Mr. Tibits and helped us put this program together, with the appropriate language and so on. I am very grateful for Jon's participation in that.

In 1994, STTR's first year, the five participating Federal agencies — the Department of Defense, the Department of Energy, the Department of Health and Human Services, NASA, and the National Science Foundation — provided almost $19 million to 181 different firms. And universities and research institutions received over $7.5 million of this total. To me this indicates that a vital need is being addressed.

Perhaps, most importantly, these programs have been very hard to criticize. For example, the Department of Defense is the largest participating Federal agency in the STTR Program, and in written testimony for this hearing it has endorsed its reauthorization.

The General Accounting Office has emphasized the quality of the research being conducted in both programs, using such descriptives as "excellent" and "cutting edge" in reference to STTR.

Moreover, it should be clear after listening to today's testimony, that those intimately involved in these programs are not only getting products out of the laboratory, but they are getting them into the marketplace.

Mr. Chairman, I would again like to thank you for your attention to these important programs, and I extend a warm greeting to our esteemed panel. Their time and expertise are greatly appreciated, and I look forward to their testimony.

[Mr. Poshard's statement may be found in the appendix.]

Chairman TORKILDSEN. Well, thank you, Mr. Poshard.

I will let all members of the Committee know that they may include in writing an opening statement, if they wish. Also, unless objection is heard, the record for the hearing will remain open until March 19 for the submission of any statements for the record.

Our witness list, I would like to introduce now our first witness will be Mr. Victor Rezendes, director, Energy, Resources and Science Issues Resources, Community and Economic Development Division of the U.S. GAO; Mr. Daniel Hill, assistant administrator for Technology Programs of the SBA; Mr. Richard Carroll, president, Digital System Resources, Inc., of Fairfax, Virginia; Dr. Brian Clevinger, president, MEGAN Health, Inc., of St. Louis, Missouri; Steven Zylstra, director of Small Business Development Simula Government Products, Phoenix, Arizona, representing the U.S. Chamber of Commerce; Robin Risser, chief executive officer of Picometrix, Inc., of Ann Arbor, Michigan; and also we are expecting Professor John Phillips, Department of Chemistry and Biochemistry, at Southern Illinois University at Carbondale will be joining us during the progress of the hearing.

I would like to ask all witnesses to please limit their remarks to 5 minutes. We will grant an exception to the GAO because we have asked for more extensive testimony on the two programs.

The GAO, if you could please limit your remarks to 10 minutes, that would be much appreciated and would allow time for questions.

Some of you who have testified before would remember that we normally have a system of flashing lights in front of you. We do not have that today. However, we will have a staff person who will politely hold up a sign as we approach your time limit. Feel free to complete your thought, and do not feel that you have to cutoff in mid-sentence. We just appreciate you adhering to the time limits, so again we can keep the hearing moving in an orderly manner and leave time for questions.

Mr. Poshard?

Mr. POSHARD. Mr. Chairman, may I just say that before the panel starts, I have a markup going on in Transportation that I am going to have to leave temporarily for. I have got your written testimony, and I will be back. I do not want you to think we are cutting out on you here.

Chairman TORKILDSEN. Thank you, Mr. Poshard.

Mr. Rezendes, if you would like to start out with your testimony.

TESTIMONY OF VICTOR S. REZENDES, DIRECTOR, ENERGY, RESOURCES AND SCIENCE ISSUES RESOURCES, COMMUNITY AND ECONOMIC DEVELOPMENT DIVISION, UNITED STATES GENERAL ACCOUNTING OFFICE, WASHINGTON, DC; ACCOMPANIED BY ROBIN M. NAZZARO, ASSISTANT DIRECTOR, WASHINGTON, DC

Mr. REZENDES. Thank you, Mr. Chairman. On my right is Robin Nazzaro, our assistant director responsible for most of this work.

I would like to talk about basically two pieces of our work. The first part is the Small Business Innovative Research Program. As you know, last year we issued a report on the status of that program. There was some concern about how the increased funding was going to impact the numbers and the quality of the research applications that were coming in.

Now, what we found at that time, although the funding percentage had just only slightly increased, was that the number of proposals appeared favorable in response to the increased funding. There was a high level of competition.

There were a large number of proposals that agencies deemed worthy of funding, but which did not receive funding because additional funds were not available. Also, the views of the agencies were generally favorable in terms of how that program was working.

There was one area of concern, and that was the potential funding of duplicate applications being submitted to various agencies. While there was only a small problem, it was one that we addressed and we had a number of recommendations to the SBA in terms of how best to improve both an information system and the controls in that program.

Mr. Hill told me today that those corrections are well underway. I will not steal his thunder. I am sure he will like to comment on that himself.

I would next like to talk about our recent report on the STTR Program. Basically, what we did is we looked at the first year's awards. They were 206 in that first year, fiscal year, 1994.

Overall, we found that obviously it is too early to draw too many conclusions from the program, since it was only in its first year and a relatively small level of funding. However, I do want to give you some information about the quality of the research applications that were funded.

Basically, what we heard from the agencies was that they were ranking these. Some agencies such as the DOE were claiming they were in the top 10 percent of the research being performed by those agencies. There were words used such as "cutting-edge technologies." In general, the agencies were classifying many as "excellent" and "top-notch."

We also looked at the evaluations in terms of commercialization of these products. While the evaluations in this area were generally favorable, they were a little bit more cautious. There was some concern about whether the final product would result in too small a market for it to be commercialized. There were also some concerns about the cost of the product.

I do want to add, though, that this is understandable, given the early phase of this program, being only 1 year old. We expect that as this progresses, we will have more information about that in the future.

One area we did have some concern about is potential conflicts of interest. Let me explain basically how that could arise. Basically, as you know, in the STTR Program these collaborations with small business could also occur at federally funded research centers.

The conflict could arise when the Federal agencies and the small businesses come into collaboration, and somehow those Federal centers are involved in or are providing counsel to the agencies in terms of evaluating applications in general or theirs in particular.

I do note, though, that the Department of Defense, Energy, and NIH have specific policies in place which we looked at that seem to be reasonable to prevent those kinds of conflicts. NSF and NASA also have general policies which appear to be effective in dealing with this.

Let me get to the real nub of what the issue is here today in terms of the reauthorization of the STTR. My bottom line is it is too early for us to draw too many conclusions in terms of its effectiveness. We do have some insights or some questions we think are relevant in terms of the reauthorization.

The first one is, as you know, the thrust of the STTR Program: There is research in our universities and research centers that is being bottled up and needs to come into commercialization and small businesses are used as a vehicle to help that.

The question we have is, Where are the research ideas coming from in this program? Are they originating at the research centers? If they are, then the objective of the STTR Program is being achieved. If they are originating mostly with the small business community, then it raises questions about whether we need the STTR Program or whether the SBIR Program would be sufficient.

The next question: While collaborations are working, are these products reaching the marketplace? Obviously, it is way to early to tell. Generally, the literature says it takes 5 to 9 years from a concept till its actual commercialization. With a program only being 1-year-old, we think we have a long time before we will have some information on that.

The final question, the third one, is: Could the SBIR Program do what is needed? That is an open question. The agencies we dealt with, NIH, for example, told us that they have a long history of collaborations with research centers. In fact, 50 percent of the NIH's SBIR proposals had such collaborations. However, on the other side, Army, which normally does not deal with the research centers, said this has been a stimulus in terms of getting these collaborations in place.

Obviously, we have a lot to learn as this program matures. I am sure we will be back testifying before this Committee with our views on that in the future.

Thank you, Mr. Chairman.

Chairman TORKILDSEN. Thank you, Mr. Rezendes.

I will have to apologize to the witnesses, briefly. I will have to ask that we stand in recess for 10 minutes because of a conflict that has arisen. I ask everyone's indulgence. The hearing will stand in recess until 10:30.

Thank you, Mr. Rezendes for your testimony.

Now we will hear from Dan Hill from the SBA.

[Mr. Rezendes' statement may be found in the appendix.]

TESTIMONY OF DANIEL O. HILL, ASSISTANT ADMINISTRATOR FOR TECHNOLOGY PROGRAMS, SMALL BUSINESS ADMINISTRATION, WASHINGTON, DC

Mr. HILL. Good morning, Mr. Chairman and distinguished members of the Committee. It is my pleasure to appear before you to discuss SBA Small Business Innovation Research, the "SBIR" Program and the Small Business Technology Transfer Program, the "STTR."

I would like to thank for your support and encouragement in creating and sustaining these two important initiatives. With your permission, I would like to submit my written testimony for the record. My written testimony details historical highlights of these programs, which I will omit in this discussion to conserve time.

First, the SBIR Program. The SBIR Program has proven popular in the small business community. Small hi-tech firms have submitted over 220,000 proposals which have resulted in over 33,000 awards worth more than $4 billion. Commercial successes associated with the program have come from a wide range of technologies and industries ranging from laser manufacturer to medical research to robotics to military decision making and others.

One example, a company named Cavitation-Control Technology, Inc., whose principal R&D business is cancer diagnosis and therapy, won SBIR awards totaling $600,000. These awards, in turn, directly assisted the firm in attracting over $1.1 million in private sector funding from 1991 to mid-1995.

The SBIR Program is alive and well, as evidenced by commercialization rates of SBIR-generated products. Approximately 24 percent of completed projects achieved commercialization within 4 years. The percentage is close to 40 percent when we consider products that are the result of more than one contributory SBIR Project.

Now let me turn to the STTR Program. As many of you know, contained in the 1992 reauthorization of the SBIR Program, the House Small Business Committee introduced a 3-year pilot called the Small Business Technology Transfer Program.

This program is unique because it requires cooperative research and development performed jointly by a lead small business and a nonprofit research institution. Most universities and colleges; nonprofit research centers; and Government-owned, company-operated laboratories are eligible to partner with the lead small business.

During the first 2 years of the pilot program, approximately 450 phase I awards valued at more than $40.5 million and, roughly, 25 phase II awards valued at more than $10.5 million were issued. I have attached a table to my written testimony detailing our fiscal year 1994 figures for both STTR and SBIR.

As an example of the success of the STTR Program today, in 1994, Advanced Device Technologies won a Navy STTR award to develop transistor technology to save power in wireless communications applications.

Advanced Device Technologies partnered with the University of Virginia on this project. The strength of this partnership attracted additional developmental funding from the Virginia Center for Innovative Technology.

Clearly, the linkage of the small business with the university stimulated outside financial support. The program is very young and commercialization studies have not yet commenced. However, given our conversations with the participating agencies, we anticipate a success rate similar to that achieved by SBIR.

As you just heard, in their January 1996 study the General Accounting Office generally supported this view. Prior to the expiration of the pilot on September 30th of this year, SBA recommends that you reauthorize the STTR Program through September 30, 2000 at its current levels.

You had asked about SBA's response to the "March 1995 GAO Report" in your letter of invitation. In their March 1995 report the GAO recommended a number of actions to reduce the risk of duplicate funding of similar research. SBA agreed with the GAO, and we have taken the steps to implement these recommendations, finishing with the installation of a computer system by the end of this fiscal year.

Let me just conclude. The SBIR and the STTR Programs are vital to the hi-tech sector of the small business community and to our nation's research agenda. This fiscal year approximately $930 million under SBIR and $50 million under STTR will be awarded to small R&D firms.

Without these valuable programs, it is doubtful that this level of participation and opportunity would exist for these firms. These competitive programs have earned high marks for quality. Just as important, they do not add cost to the Federal budget.

Finally, as a result of these programs, there is a flow of innovative new products and services to the American marketplace. For these reasons, the SBA strongly urges the Committee to continue both programs at their current levels.

Thank you for your attention. I will be happy to answer any questions you might have.

Chairman TORKILDSEN. Thank you, Mr. Hill.

We will hold time for questions until after all witnesses have testified. Now we will hear from Mr. Richard Carroll.

Mr. Carroll?

[Mr. Hill's statement may be found in the appendix.]

TESTIMONY OF RICHARD W. CARROLL, PRESIDENT, DIGITAL SYSTEM RESOURCES, INC., FAIRFAX, VIRGINIA

Mr. CARROLL. Thank you.

As president of Digital System Resources or DSR of Fairfax, Virginia, I am pleased to address this Committee on the SBIR and STTR Programs. DSR's experience with the SBIR Program began in 1987 and continues today to be a significant element of our business activities.

We have submitted numerous phase I, II, and III proposals to agencies of the U.S. Government, and have concentrated primarily in the DOD on innovations to enhance our country's aging weapon systems.

We have had excellent success on these proposals including over $65 million of sales in phase III follow-on contracts. Our company's products are making a significant contribution to our Nation's defense, and this would not have been possible without the SBIR Program.

First and foremost, it is my opinion that within the defense sector today these programs offer the only viable pathway for a small business to make significant high-technology contributions to our country's aging weapon systems.

Over the past several years, the defense marketplace has changed significantly. We have seen the U.S. defense budget shrink substantially. We have seen large defense contractors substantially reduce their high-technology subcontracting. In general, the defense marketplace has changed in ways that significantly limit small business access to the high-technology sector.

On the other hand, the defense marketplace has changed to be more suitable to small business solutions. Recognizing the need to modernize our aging weapons systems with the latest in technology advances, the DOD has opened their door to solutions derived from commercial-off-the-shelf components. No longer does a business need to be a manufacturer of complex military equipment in order to provide the DOD with effective solutions to many of their complex weapon system problems.

The SBIR and STTR Programs are now more essential than ever. They offer a unique structure for introducing high technology from small business into the defense marketplace. They offer a "fly before you buy" approach which gives small business adequate funds to provide an advanced technology demonstration before any commitment has to be made to purchase their technology.

In addition, these programs provide adequate protection and opportunity for follow-on procurement to ensure enthusiastic and motivated small business participation.

The best illustration of our company's success in the SBIR Program is the development of Multipurpose Processor or "MPP." This activity began in 1991 with two SBIR awards given to our company dealing with commercial-off-the-shelf solutions for submarine combat systems.

Over the course of the last 5 years, these efforts have developed into a submarine sonar processor which has now been selected as the cornerstone of the sonar upgrades for our Los Angeles and Trident Class Submarines.

The Navy replanned its modernization of the U.S. submarine fleet to capitalize on the MPP and rapidly deliver major sonar capability improvements significantly earlier than originally planned.

By following the SBIR procurement process, the MPP Program took on characteristics reflective of the visions, goals, and actions identified by Colleen Preston in her statement on acquisition reform.

Her reengineered acquisition system envisions the DOD as the world's smartest buyer, where and I will quote: "There are incentives for personnel to innovate and to manage risk rather than avoid it; and where maximum advantage is taken of emerging technologies."

The SBIR Program is designed to innovate and take advantage of emerging technologies, and by forming a partnership between small business and DOD technical representatives innovation can and does occur. It is through this partnership that such innovation can make significant contributions to warfighter needs.

Our experience in the STTR Program has been very similar to that in the SBIR Program; although, less mature. We were able to come to a successful business arrangement with our research partner, Duke University, and expect to derive significant benefit from their activities as our STTR activity matures. Our phase II STTR proposal already incorporates a phase III funding agreement.

The characteristics of our partnership are that Duke University has a basic research orientation whereas our company is focused on applying advanced technology to the marketplace, whether that technology originates at Duke University or at our company. This partnership stimulates the transition of basic research from the university environment into the commercial marketplace.

Our relationship with Duke remains a positive experience with the added benefit of giving us a proven source of well-trained professionals for our company and giving their graduate students successful small business employment opportunity.

I consider the STTR Program a significant complement to the SBIR Program in that it generally involves more basic research while still providing all the advantages that come from the SBIR Program. The STTR Program should be reauthorized and allowed to mature to its natural position along side the already successful SBIR Program.

Chairman TORKILDSEN. Thank you very much, Mr. Carroll.

Now we will hear from Dr. Brian Clevinger.

[Mr. Carroll's statement may be found in the appendix.]

TESTIMONY OF BRIAN CLEVINGER, PRESIDENT, MEGAN HEALTH, INC., ST. LOUIS, MISSOURI

Dr. CLEVINGER. Thank you, Mr. Chairman.

I appreciate this opportunity. My professional career has given me a clear view of the importance of STTR and SBIR Grant Programs. I have seen the impact of these grants from the perspective of a university professor, a technology transfer professional, a venture capitalist, and a CEO of a biotech startup company.

From that perspective, I feel strongly that these programs address the critical national need for fostering transfer of technology from universities into new companies. As I will describe, the STTR Program has a special role that is quite separate and vital to the technology transfer process which is not addressed by the SBIR Program.

Let me give you a little bit of my background, and how I come to this perspective. From 1980 to 1987, I was an NIH-funded assistant and associate professor at Washington University in St. Louis.

During that time, I was involved in basic research on the regulation of immune responses. I worked on technology, the monoclona antibody technology, that was part of the biotechnology explosion that began in the late 1970's.

In 1987, I left full-time employment with the university and joined the A/W Company, a partnership between Washington University in St. Louis and Alafi Capital, a California-based venture capital fund. The purpose of the partnership was to commercialize technology originating from the university.

From 1987 to 1993, I worked very closely with innovative university professors, university technology transfer managers, as well as with venture capitalists funding early stage technology companies.

During a 7-year period, the partnership funded the development of six new companies all based on technology developed by university faculty. My role was to perform due diligence on company formation including detailed analysis of technology, patents, and commercial opportunities. I also served as initial management for these companies, and helped hire their initial management. For some of these companies, I helped write SBIR grants, two of which were funded.

The last company formed from the A/W partnership was MEGAN Animal Health, my current company, a company developing vaccine technology for animals and humans. As an immunologist with considerable startup experience, I was given the opportunity to manage this company from its beginnings 2½ years ago.

In addition to a sizable investment by Alafi Capital and a major pharmaceutical company, our company has successfully competed for two STTR grants from the NIH with one additional grant pending.

We have written three SBIR grants, one is pending and two have been rejected.

Why have we successfully competed for STTR grants and not for SBIR's? The reason is that the PI for the SBIR must be substantially employed by the small business submitting the proposal. For the STTR, the PI can be an employee of a nonprofit research institution. This is a critical difference, because the scientists that review these grants are the same that review other types of Government grants such as the RO–1 awards from the NIH.

These grants are highly competitive and funding depends heavily on the resume of the principal investigator. Therefore, to successfully obtain an SBIR or an STTR, the application must have a PI with extensive credentials. Most startups cannot afford such individuals in their early stages. The cost of one high-profile scientist can easily fund two or three more junior investigators.

In MEGAN's case, we utilized Dr. Roy Curtiss, the scientific founder and full-time faculty at Washington University as the PI for our STTR grants. Our SBIR grants were written with a great deal of input from Dr. Curtiss, but the PI's were our young scientists. None of our SBIR's have been funded, all of our STTR's have been funded.

Let us look at this issue from different perspectives. First of all, from the university perspective: A university wants a mechanism for faculty to commercialize technology, but does not want to lose the faculty member to a new company startup. This can be a very significant drain on the intellectual resources of the university community.

The STTR Program allows for professors to take part in the development of their ideas without having to leave the university. The SBIR Program is also a potential transfer mechanism that only allows faculty members to work with companies that have specific expertise and documented track records in the same technological area. This is often a very great limitation because very few, if any, companies have cutting-edge expertise that is found in the university.

From the faculty point of view, naturally at nonprofit institutions, researchers want to see their ideas benefit mankind and often this requires commercialization. Thus, the temptation to move with their ideas, that is, to move into a company is very strong.

The problem is that moving to a small company is a very high-risk proposition. Again, the STTR Program allows the investigator to stay in the university with the attendant benefits and still allow his or her ideas to be commercialized, from the small business point of view.

Many small technology companies cannot afford high-priced scientists as well as experienced management. The tradeoff often is made that the scientist is asked to run the company as well as being the primary scientist.

This rarely works in our experience. It is far better to hire an outstanding manager with good credentials as a manager. Most venture capitalists would agree with this. Good management is always a key to success. Scientific expertise can often be outsourced.

In summary, I feel that the SBIR and STTR Programs have roles in technology development and transfer. In my judgment it would be hard to justify one over the other. They are different mechanisms to achieve the end of developing new technologies and commercializing them. I hope that this Committee will continue its support for both the STTR and the SBIR Programs. They are both important and effective.

Chairman TORKILDSEN. Thank you for your testimony, Dr. Clevinger.

Now we will hear from Professor John Phillips.

[Dr. Clevinger's statement may be found in the appendix.]

TESTIMONY OF PROFESSOR JOHN B. PHILLIPS, DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY, SOUTHERN ILLINOIS UNIVERSITY AT CARBONDALE

Mr. PHILLIPS. I would like to thank the Committee for this opportunity to comment on the Small Business Technology Transfer Program and the Small Business Innovation Research Program.

During 1995, Southern Illinois University at Carbondale in collaboration with Zoex Corporation of Lincoln, Nebraska, a small business currently with two employees, received research funding through the STTR Program of the National Science Foundation. I am the university collaborator involved in that project.

This STTR funding was used to enhance an existing relationship between the university and the business. The goal of the STTR funding was to develop an idea, which originated in my laboratory, into a commercial product to be sold by the business.

This STTR funded collaboration has been very successful. Briefly, the product developed by this collaboration is an instrument and method for chemical analysis of organic mixtures. The method, known as comprehensive two-dimensional gas chromatography, is a major advance of older techniques. Using it we can make chemical measurements that can be done no other way.

For example, we can observe over 6,000 individual chemical substances and mixtures like gasoline. There are numerous potential applications, especially in environmental chemistry and the petroleum industry.

Federal funding for the research to develop this project has been very difficult to obtain. I have had support for the projects, but only a small amount of NASA support and one part of a small NSF grant were devoted to this project. The initial basic research on the technique was done without external support.

Collaboration with the small business was established because the business owner recognized the commercial potential, which I had not seriously considered, offered to pay for patent applications and committed the business' resources in exchange for a license from the university.

When the STTR Program at NSF was announced, I realized it fit our situation exactly. It was specifically aimed toward collaborative development and commercialization of analytical instrumentation. We decided to prepare a jointly authored proposal.

As it turned out, this was a very good decision because my other proposals to NSF and EPA were not funded that year. For a year, the university's share of the STTR collaboration was my only research funding.

I also decided that some concentrated effort on my part was needed to get the commercialization moving, so I took a 1-year sabbatical leave, which was partially funded by the STTR grant, to work with Zoex and other collaborators.

Phase I of this STTR grant has been very successful. At the beginning of the year, we developed a new approach to the instrument design. A jointly authored patent application was filed. This new approach was taken through several design iterations and delivered to three customers for their evaluation. It is working well at all three sites, and all three customers have indicated they intend to order a second instrument. Total sales received or in process at this time amount to more than twice of the STTR funding.

One of the early customers is the Centers for Disease Control. Our collaboration with CDC has resulted in an improved method for dioxin analysis that has the potential to save the Government several million dollars in chemical analysis costs over the next few years.

A second customer is Royal Dutch Shell, Amsterdam. This sale was an export which by itself brought in foreign exchange almost equal to the STTR phase I funding.

I have received a research grant from one of the early customers to help support my university laboratory for 3 years at $25,000 per year. This has also resulted in a new collaboration which helps make my students more knowledgeable about real industrial problems and may help them find jobs when they graduate. Full scale marketing of the instrument is beginning just this week with a mass mailing.

There is still much to be done with this research project, however. We have in mind several improvements to the instrument. Example applications need to be explored in several areas particularly environmental chemistry. I am optimistic that we will receive phase II STTR funding to continue the collaboration.

I have had one previous experience with the SBIR Program as a consultant to a small business, which obtained a phase I grant based on an idea of mine. That project, which was about 12 years ago, did not reach commercialization because it required much more effort than could be supported by the SBIR grant, and the business was not willing to risk substantially more of their own money.

From my perspective, it was useful anyway because it helped develop new ideas and it made me and my students more aware of the business research opportunities and problems.

There seems to be some similarity in structure between SBIR and STTR, but I definitely prefer the STTR Program. Its emphasis on collaboration is very good, because it brings people with different ideas and perspectives together. I do not think all SBIR grants should require collaboration, but it should certainly be encouraged.

STTR also seems to have a stronger emphasis on commercial potential, at least the NSF-funded program did, and so is likely to produce a higher proportion of commercial successes. I personally think that STTR should certainly be reauthorized.

One improvement to the STTR Program that I would suggest is some mechanism to get closer to a continuity of funding between phase I and phase II. We are currently between the two, and so have no funding either in the business or the university for this project.

It is very difficult for a really small business to stop work on a project for a few months, and then restart it after phase II is granted. It is also difficult to have university students work on a funded collaboration which becomes unfunded for a period of months and is then funded again.

Perhaps, the funding agencies could accept a phase I final report early if the collaborators have achieved their goals and are ready to proceed. Early completions are likely to be the most successful projects and the possibility of funding continuity would act as an incentive for rapid and efficient progress.

Thank you.

Chairman TORKILDSEN. Thank you, Professor Phillips.

Now we will hear from Steven Zylstra.

Mr. Zylstra?

[Mr. Phillips' statement may be found in the appendix.]

TESTIMONY OF STEVEN ZYLSTRA, DIRECTOR OF BUSINESS DEVELOPMENT SIMULA GOVERNMENT PRODUCTS, PHOENIX, ARIZONA, REPRESENTING U.S. CHAMBER OF COMMERCE

Mr. ZYLSTRA. Mr. Chairman, members of the Committee, thank you for inviting me to appear before you to present the experiences of Simula, Inc., for the SBIR and STTR Programs. I am Steven Zylstra, director of business development for Simula Government Products, a subsidiary of Simula, Inc. I am speaking on behalf of both my company and the U.S. Chamber Federation of which Simula is a member, and I also have served as a member of the Chamber's Small Business Council for 6 years.

Today, I want to impress upon you the positive impact that the SBIR Program, in particular, has had on the success of Simula and the growth of our technologies and product lines and especially what this success and growth means in the lives of our employees and customers.

Simula was founded 20 years ago by a man with an idea for saving lives by improving the crashworthiness of military aircraft seating. Saving lives remains the guiding force behind Simula's research and development efforts, despite our expansion into many other technology areas.

The expansion took a tremendous leap between 1984 and 1994 when Simula received 24 phase I SBIR awards and 9 phase II's, totaling more than $4 million. Those awards enable a small company with a relatively narrow focus to do what it probably could not in the same period of time and to the same degree — create jobs, buy equipment, add facilities, acquire businesses, form alliances, broaden marketing efforts, expand expertise.

In short, the SBIR Program enabled Simula to grow faster and contribute more. In those 10 years, Simula went from a company employing 45 people to one with over 500. Sales increased from $4 million to $41 million. Customer base became worldwide and included commercial as well as military business. Research and development broadened to include many more technologies and applications.

Today, Simula is no longer a small company by SBA definition. We are a publicly held, Arizona-based corporation with subsidiaries in California, North Carolina, Illinois, Wisconsin, as well as Arizona. We have an ever-increasing employee roster and projected sales revenues for 1996 of $80 million.

We have transformed from a company that depended nearly 100 percent on defense-related business to one that now receives 50 percent of its revenue from nondefense sources. Core technologies now encompass crash safety, armor, composites, polymers, and personal protective gear.

Developments include crashworthy seating for ground vehicles and aircraft, airbags, crash test dummy components, structural health monitoring devices, armor, emergency flotation devices, and even parachutes. Our R&D efforts have resulted in 14 patents for innovative products and processes.

We believe that Simula's success is proof the SBIR Program meets its objectives, and in doing so makes an important contribution to the U.S. economy and our quality of life by creating jobs, sparking economic activity, and expanding our knowledge. As examples of what I mean by this statement, I would like to briefly present the history of two Simula SBIR-funded projects.

In 1986, Simula had no experience in designing parachutes nor any plans of doing so. The company, however, did have a technician with a strong interest in skydiving and an idea for improving the equipment. He used this interest and idea to persuade management to respond to a Navy SBIR solicitation. This kind of event in itself is unique to small business.

Unlike with many large corporations, communication is not usually bridled by bureaucracy and policy. A single technician can have a conversation with the president and actually alter a company's future. Simula received phase I funding in June 1987 and phase II funding in August 1990.

The outcome was an innovative parachute that is much lighter than the ones currently in use; is protected from the environmental elements by vacuum packaging; is comfortable for both male and female crew members; does not have to be repacked for 5½ years; and has an improved canopy that opens quickly and provides a low descent rate. There is a photo up here [indicating] on the easel of that system compared to the existing Navy system.

The product fully meets the user's requirements and was developed at a relatively low cost to the customer, another occurrence that does not always happen in the ordinary course of business. It happened because the Navy's SBIR technical monitor for this project championed the cost for a parachute that would truly save lives because Simula listened and delivered.

The project has recently moved into phase III with a Navy contract for $368,000, or if all options are exercised over $960,000, to complete the qualification process and to prepare for production. The current potential benefits derived from this project are numerous and will be shared by the country, Simula, and the individual alike.

Technology will save lives and lessen injuries; reduce maintenance and replacement costs for the customer; create jobs, especially as the parachute moves into production; be applicable to cargo and ordnance delivery; serve civilian as well as military aviation; open new markets for Simula both here and overseas; and expand Simula's capabilities.

Unlike the circumstances surrounding our response to the parachute solicitation, Simula had the benefit of many years of applicable experience when it responded to an Army SBIR in 1989 for a helicopter cockpit airbag system. Simula received phase I funding in August 1989 and phase II in December 1991.

Using the expertise and knowledge we gained in our development of crashworthy helicopter seating, we proposed an airbag crash protection system that specifically addressed the realities of attack helicopter cockpit environment and crash characteristics. The result was the cockpit airbag system, which you will again on the easel.

CABS includes lateral and frontal airbags which provide wrap-around protection to protect crew members from striking interior parts of the aircraft and reducing involuntary head motion, general flailing, and rebound. It also continues to provide protection during subsequent impacts. Testing further showed that the system is safe and does not create a hazard in the event of inadvertent deployment.

The CABS project moved into phase III in May 1994 with a joint program with the Army, Navy, FAA, Air Force, Marine Corps, and Coast Guard for $4.3 million and in July 1995 with an Army contract valued at $4.4 million.

The purpose of the joint program is to continue the development of aircraft, airbag technology using the UH–60 family of helicopters as a demonstration platform. The Army contract asks for a cockpit airbag system that is specifically designed to produce for the AH–64 Apache helicopter.

Like Simula's sealed parachute project, the current and potential benefits derived from the project are numerous and shared. Technology, too, will: Save lives; lessen injuries; create jobs; and serve commercial and civil aviation, as well as military.

The knowledge and capabilities we gained as we pursued the CABS project have and will continue to have a dramatic impact on Simula's future. What we learned led us to enter and become a leader in the automotive crash protection field with our development of a side-impact protection system.

In order to effectively commercialize this system, Simula recently created ASD-Simula, a subsidiary devoted to handling the commercialization of this and future automotive safety innovations. The side-impact protection known as the ITS, or "Inflatable Tubular Structure," will be installed in 1997 BMW's. Again, there is a picture on the left.

The discoveries and accomplishments we made with the CABS project have opened new possibilities for us in the commercial aircraft market. Currently, we are developing a bulkhead airbag system for this market. Simula is undertaking this project in response to new FAA regulations regarding protecting passengers from striking aircraft bulkheads in survivable crashes.

Unlike SBIR, STTR is not one that I can speak about from experience. Simula has not participated in STTR, which does not keep me from having an opinion and sharing it with you today.

As I understand it, STTR provides a mechanism that allows mutually beneficial partnerships between not-for-profit research institutions such as universities and national labs and the for-profit small businesses to share discoveries, innovation, and knowledge.

These partnerships between well-funded institutions and not-so-well-heeled small businesses rarely occur naturally. Yet, they can do a lot to advance us technologically, promote us economically, and depending on the particular project benefit us individually in many ways.

I recommend that the STTR Program be continued through the current sunset date for the SBIR Program, which I believe is the year 2000. I have a number of recommendations from improving the STTR Program, which are in my written statement. I would like to thank you for an opportunity to speak to you today, and I will be happy to answer any questions.

Chairman TORKILDSEN. Thank you, Mr. Zylstra.

We have one more witness, and then we will be opening up for all questions.

Mr. Robin Riser, your testimony, please.

[Mr. Zylstra's statement may be found in the appendix.]

TESTIMONY OF ROBIN F. RISSER, CHIEF EXECUTIVE OFFICER, PICOMETRIX, INC., ANN ARBOR, MICHIGAN, REPRESENTING NATIONAL SMALL BUSINESS UNITED

Good morning. My name is Robin Risser. I am a founder and the CEO of Picometrix. In addition, I serve on the National Small Business United's Technology and capital formation Committees. In 1995 I participated as a White House Conference on Small Business delegate, and serve currently as Region V technology implementation co-chair.

Picometrix is located in Ann Arbor, Michigan. Steve Williamson and I founded the company 4 years ago to develop and manufacture technology originating at the University of Michigan Center for Ultrafast Optical Science. To date, the company has received seven SBIR awards, but has not yet won an STTR contract.

Last year, we introduced a family of fast photodetectors for the fiber-optic communication, scientific and laboratory markets. Without the SBIR Program, these products would not have gotten to market.

SBIR contracts have enabled Picometrix to transfer the technology from the University of Michigan and further develop the technology with U of M research graduates. Success in developing these technologies with SBIR contracts has enabled us to enter into worldwide sales, marketing, and distribution arrangements with corporate partners.

Based upon our experience, I am certain that technology can be transferred from research universities to small businesses using the SBIR Program. I also believe it can be transferred using the STTR Program. However, personally I recommend changes be made to strengthen the small business chance of commercial success. These changes include:

First, requiring that all inventions developed with STTR funds be owned by the small business; second, reducing conflicts of interest by preventing university-owned small businesses from qualifying for STTR funds; and, third, reducing the maximum amount of STTR funds that can go to the research institution.

The White House Conference on Small Business recommendation number 406 is entitled, "Investment Initiatives for High-Tech Firms" included expanding, improving and making permanent the SBIR and STTR Programs. I would like to elaborate on one very important aspect of improving the SBIR and STTR Programs.

The SBIR administrative process should be improved in order to shrink the administrative delay. Total cycle time from submitting a phase I proposal to completing the phase II research takes too long, typically 3½ to 4 years.

The R&D itself typically takes 2½ years. Thus, the administrative lag in the system is 1 to 1½ years, or up to 38 percent of the total elapsed time. In today's global economy with short product development cycles, we need to do better. The total SBIR cycle should be reduced to 3 years through administrative efficiencies that could be realized across agencies.

The Department of Defense has recently enacted the Fast Track Program in an effort to significantly reduce the administrative lag and thus shorten the total cycle time as well as improve the commercialization potential. The White House Conference delegates applaud the goals of this pilot program.

While we disagree with some of the requirements for qualifying for the Fast Track, we are confident that it will serve as a constructive model for improving the total cycle time of the SBIR and STTR process.

The White House Conference technology chairs have also been working closely on streamlining the SBIR/STTR administrative process with Dan Hill, SBA's Assistant Administrator of Technology Programs. We have found Dan to be a man of action and are extremely pleased with the cooperation, direction, and leadership Dan has provided in the short time that he has occupied this position.

As I previously mentioned, Recommendation 406 is entitled, "Investment Incentives for High-Tech Firms," but is known to the White House Conference delegates as the need for long-term patient capital. Improvements in facilitating investment of patient capital in SBIR companies, has the greatest potential impact of any actions you could undertake to improve the commercialization of the SBIR research.

Despite the fact that our financial markets and venture capitalists are having record years, the availability of private investment to further develop SBIR and STTR technology and markets suffers from an acute shortage of available capital. This is the high-risk capital required to move a technology from the startup and seed stage to the rapid growth stage preferred by the venture capital industry.

The early stage capital is typically provided by angel investors. Unfortunately, the angel capital market is very inefficient, due in large part to regulatory and educational barriers. The advent of the Internet and the information superhighway combined with the removal of these barriers offers tremendous opportunities to make this market more efficient.

This could provide significant new capital to SBIR companies for phase III commercialization. White House Conference delegates have been working closely with Jere Glover, SBA's Chief Counsel for Advocacy, and Terry Bibbens, SBA's entrepreneur in residence, on this issue. Their work on angel capital and all aspects of technology commercialization are wholeheartedly supported by the White House Conference delegates. We feel privileged to have such dedicated and knowledgeable individuals working in the SBA.

In Summary, the White House Conference delegates support the STTR reauthorization. I personally believe that some changes should be made to the STTR Program in order to strengthen the small businesses' chances of commercial success.

In addition, both the STTR and the SBIR Program can be substantially improved by, first, reducing the administrative lag in the system; and, second, improving the availability of angel capital.

Thank you.

[Mr. Risser's statement may be found in the appendix.]

Chairman TORKILDSEN. Thank you, Mr. Risser for your testimony. I will ask two brief questions before turning over the chair to Congressman Manzullo from Illinois.

First off, would anyone who testified like to offer any disagreement or a different perspective with any other testimony that was offered this morning?

We have a very broad-based panel; but if anything was said that you thought you might have a different perspective on, please say so now.

The other question that I have is for those of you who have testified in favor of reauthorizing STTR. Would you prefer to see it as a separate entity, would a hybrid with SBIR be a possibility, or do you really think it should be reauthorized as a separate entity with or without whatever caveats you may have offered in your testimony? Would anyone like to tackle that at all?

Mr. Hill?

Mr. HILL. Thank you, Mr. Chairman.

We believe strongly at the SBA that the STTR is a unique program in that it does bring the ideas from the university, marry them with the entrepreneurial expertise at the small business. We are fearful that if it is folded back into the SBIR Program it would be lost.

Chairman TORKILDSEN. Any other comments?

With that, I will turn the gavel over to Congressman Manzullo, and again thank all the witnesses for their testimony.

Mr. MANZULLO. [presiding]. Mr. Poshard?

Mr. POSHARD. Thank you, Mr. Chairman. Just let me ask as sort of a general question to whomever would like to respond. One of the findings that we were aware of before we began the STTR Program and had continued even through the beginnings of the SBIR, all the way back in the 70's and early 80's, was that foreign countries were taking our basic research, which was being conducted in our university settings, and purchasing that off the shelf, to a large extent, and using that as applied research in product development, while we had supported and paid for the basic research for some time.

Do you see the efforts of SBIR and STTR beginning to have some effect on that problem, or are we still experiencing that with respect to our country? I mean, it does disturb the citizenry of our country sometime.

I have had this brought up to me in my own meetings back home, about seeing foreign governments sponsoring research chairs at our major universities, and buying our basic research right off the shelf and taking it home and creating products with it and beating the socks off of us with it in the marketplace. Will this help to change that? Is it helping in any way that you can see, or are you even aware of that at this point in time?

Mr. Risser?

Mr. RISSER. I think that issue speaks to university technology transfer policies. University researchers are primarily driven to get adequate resources to continue their research. It is that struggle for adequate resources, which I think is the first driving factor, I do not believe commercialization is the ultimate driving factor that motivates the majority of those researchers.

In the university structures that I am familiar with, the entire technology transfer policies and contract research and development policies would need to be reexamined in order to address that particular situation.

I think that the more emphasis that can be placed by the country on the importance of the economic development role that research institutions have, the more you will see technology transfer policies change in favor of interfacing with businesses. The more the research institutions are able to conduct business as usual without that, the less motivation they will have to make those changes.

Mr. POSHARD. Then all of you see it as appropriate to develop programs like this which would move that pure research, so to speak, or basic research into product development as a pragmatic way of enhancing economic development roles of universities? You think we ought to encourage more of that?

Mr. RISSER. Yes. I do think we should encourage it.

Mr. POSHARD. OK.

If anyone else wants to comment on that, they can.

Yes, Dr. Clevinger and Mr. Phillips?

Mr. PHILLIPS. My particular project from the beginning has generated more interest in Europe than here, and probably would have been commercialized there except for the STTR Program and this one small business that was interested in doing it. Here is one example.

I of course am interested in seeing it commercialized. Whoever is willing to do it, whoever has the money for it will be the one that gets it, whether or not they are domestic or foreign. In this case, STTR kept it within the country.

Mr. POSHARD. OK.

Dr. Clevinger?

Dr. CLEVINGER. Basically, technology at universities gets commercialized — this is a bit of a simplification — in two ways: First, is through a development of a new entity, and the second is just pure licensing of that technology to an established company. Of course, these programs help create recipients for licenses as well to generate new entities. Clearly, this is a good answer for what your concern is.

The other issue, though, is that some of the technology that we have developed out of Washington University has ended up overseas. The reason is because of broader patent protection that is achievable from European patent offices. I think that is universally true. Second, the regulatory agencies particularly in Europe, let us say, are much easier to deal with than are our own regulatory agencies.

Regulatory processes can take years and years and years, and often causes at least early product development and early commercialization to occur overseas. I see the regulatory agencies and patent offices being another part of this problem.

Mr. POSHARD. The pragmatic effect of the product development is going to flow wherever the implementation is easiest from a regulatory standpoint and other ways?

Dr. CLEVINGER. Every company, and particularly small companies, have this incredible difficulty of surviving until they produce their product. If a regulatory agency is the primary hurdle that the company has to get over, then the company will take the fastest path over that hurdle. Remember, when you are a small company the key is to make the initial investment capital last as long as possible and to achieve the most important milestones.

Often, you do not have to get to cash-flow positive, but what you do want to meet significant milestones. Approval from a regulatory agency is a clear measurable milestone to achieve.

The mainstream venture capital community is not excited about really early stage companies. They are interested in companies who have hit a milestone such as positive cash flow. It is sometimes easier to hit those milestones in Europe.

Mr. REZENDES. Mr. Chairman, I just would add a footnote to what is going on here. We did not look at that, but in 1992 we did look at the success of the SBIR Program in terms of the commercialization of products. We did look at those phase II projects and what kind of sales were going on there, and there was about a half-billion dollars in sales already from phase II. One thing of note there. About 13 percent were exports overseas, so there is an impact. Obviously, there was a market niche that this was satisfying.

Mr. POSHARD. It is interesting.

Yes, sir?

Mr. ZYLSTRA. I just wanted to reiterate the points that my colleague on the left made, my left, and that is, that this really has to do very much with the universities' technology transfer policies.

We are undergoing a reengineering of those policies in Arizona as it applies to the State institutions to provide, one, more incentive for the universities to transfer these technologies to, in this case, Arizona-based companies.

Two, to provide incentive for faculty to pursue commercialization of their technology, to give as much credit as possible for things like partnerships and licensing and so on, as are currently given for publishing papers and so on.

You started this discussion by describing foreign countries buying this technology off the shelf. I think more than that they are taking it off the shelf because of the way we are very open about publishing our research results. I am not suggesting we should change that, but that is a very difficult issue to overcome.

Mr. POSHARD. Thank you.

One more question, Mr. Chairman, if I may. Those of you from the universities can speak to this. Dr. Clevinger, I was interested in one of your remarks. I know one of the points of controversy when we were going through the development of the legislation on STTR was that we were giving the professorial ranks broad latitude here to make a lot of money to utilize public laboratories to do that, and yet they do not have to leave their university setting. They are still invested in the product even if it is developed there and so on.

I contended during those times that to do the opposite is going to deplete our professorial ranks and not give them the incentive that they need to really develop the kinds of products we need to with the small business community. Am I right or wrong about that? What has experience shown us here over the last few years since these programs have been operating?

Dr. CLEVINGER. You are 100 percent right.

Mr. POSHARD. Good.

Dr. CLEVINGER. It seems to me that most excellent researchers in a university have an idea that can generate some sort of a product or even a business. I cannot think of any better way than using the free enterprise system to have that idea come out and benefit mankind. If it benefits the pocketbook of the inventor, so be it. Why should these inventors in the university be any different than an inventor out in the nonacademic world?

I think if we want our technology transfer process to work efficient and effectively and not have technology go overseas, then we should be encouraging professors to take their ideas and get it out there in the world. If they benefit in the pocketbook, that is great. Professors do not make a lot of money, by the way. It is not like you are making the rich richer.

Mr. POSHARD. OK.

Thank you, Mr. Chairman.

Mr. MANZULLO. Mr. Bentsen?

Mr. BENTSEN. Thank you, Mr. Chairman.

Following up on my colleague from Illinois, I think you are right, it is a form of compensation for academics that they might not otherwise get. We have not decided in this country yet that we are going to subsidize their compensation in lieu of allowing them to participate in the free enterprise system.

Needless to say, as one who represents the largest medical center in the country, I have heard the other side of the story from some of the well-funded, nonprofit universities who have raised some concerns about the SBIR and the STTR Programs.

I guess I would ask both the SBA and the GAO people: Their concerns — and I am not convinced either way — are perhaps that this SBIR and STTR actually hamstrings some of these universities which are doing a great deal of NIH research. Have you found any of that in your studies of this?

Mr. REZENDES. No. It did no surface very much. I do know that 50 percent of the SBIR awards with NIH are with collaborations with universities. I know they have a high collaboration rate and they are comfortable with it even outside the STTR Program.

As I mentioned earlier, on the defense side, we see that not as much because those relationships have not been normally there between the defense agencies and the research community, but those are developing.

I do not know if you have anything.

Mr. HILL. I do not have much to add. I would agree with what the GAO has just said. I would also add that under STTR it is a fairly small program at the current time. We expected to max out this year when the percentages are at its highest level around $50 to $60 million. When you consider the total research and development budget for the country, it seems like it is a fairly small part of that.

Mr. BENTSEN. I would ask the panel — and I will just focus on NIH right now, "National Institutes of Health — " there have been some who have proposed that we reduce our research budget at NIH by 5 percent real spending over a 7-year period. In fact, that was in the budget resolution that was adopted by the Congress in the last year. Now, the appropriation, which has gone through, would actually increase NIH by about 2½ to 3 percent real.

My question would be, Do you believe that if we do follow through, and I do not agree with this, but if we were to follow through and cut NIH by 5 percent over the next 7 years, should that proportionately follow through to the SBIR and the STTR Programs?

Mr. REZENDES. I think it would.

Mr. HILL. Well, as the system is currently set up, the SBIR percentage is set by law at a percentage of the total extramural budget for the agencies. If the budget goes down, then the SBIR award amount would also go down.

Mr. BENTSEN. I guess my question is more of a political question, rather. I realize that it works on a prorata basis of the overall budget. I would speak more to the participants of the program. Do you think this is a program that should be reduced in line with everything else?

Mr. RISSER. I think that it depends upon what your objectives are. If your objectives are to transfer technology into the commercial sector and also satisfy agency missions, then I would say no. If there is a different objective, obviously the answer would be different. I think it depends upon what outcomes and what relative importance you place on those outcomes.

Mr. BENTSEN. I think the objective was to balance the budget. The question is, of course, we have to make these choices. I think this underscores how difficult these choices become.

Mr. MANZULLO. Would you yield?

Mr. BENTSEN. I would be glad to yield.

Mr. MANZULLO. With regard to the budgetary question, my understanding is that aside from the administrative staff within the SBA to administer these programs, what we are talking about is a fixed percentage coming from research budgets in different departments. Are you talking about an overall reduction in R&D budgets that would find its way down to these programs?

Mr. BENTSEN. Well, reclaiming my time, to answer your question, and then I will tell you where I am going with this.

Mr. MANZULLO. Sure.

Mr. BENTSEN. I think the question I was asking, if we were to make this cut, and right now we are not for fiscal 1996 and we will see about 1997, 1998, and et cetera, the prorata share would stay the same if we were to go down 5 percent.

The question I had for the participants of the program, I guess to be more specific, would you be coming back to us and saying, "Well, gee, it was 1¼ percent of the overall R&D budget in fiscal 1997 and you cut the fiscal 1997 budget, so we think you ought to raise that 1¼ to 1½ or whatever, to get away from the percentage back to the dollar value"? That is the question I am asking.

If we end up going down this road, are we going to run into this problem where you want us to raise the allocation within the NIH budget or other budgets, for that matter? Does that sort of make sense?

Mr. ZYLSTRA. Mr. Chairman, I would like to suggest that I think the small business community in general is very interested in making sure that this program is preserved, and that if this program takes some hit, like many other programs are going to take, as the Congress tries to balance the budget, I think that is an issue or an impact that the small business community is willing to take.

That assumes, of course, that the program continues the way it has, and that it does not go the way of the ATP and the TRP Program. I would suggest that small business community is prepared to take some hit, as long as the program is preserved.

Mr. BENTSEN. I am a big believer in the NIH and in these programs, and I think they are where we have a competitive advantage that we ought to be maintaining, but I am just trying to get some background. I actually was going to ask you about the ATP, but you have already spoken to it. I think that is good.

Mr. RISSER. Can I make just one comment on that?

Mr. BENTSEN. Yes, sure.

Mr. RISSER. I think also if you put the SBIR and STTR Program in context relative to the percentage of extramural R&D that small business really conducts with the Federal Government, you will find that overall small business does not receive a high percentage. I think it is somewhere in the 10 percent range.

The relative share of market, that the small business community has on agency research and development is already dramatically underrepresented relative to the contribution of small business to the economy.

I believe that it is lower than it should be from an overall research and development market share of the Federal Government extramural R&D expenditures, since small business contributes approximately 50 percent of the GDP.

Mr. BENTSEN. Yes, sir?

Dr. CLEVINGER. There might be a slight distinction between the STTR's and SBIR's with regard to one issue. I do not know this from looking at any data, but I would argue that the RO–1 mechanism at the NIH probably fuels an awful lot of STTR grants.

In our case, the basic research done under an RO–1 NIH grant generated many of the ideas became the subject of an STTR grant. I think it would be difficult to say that one is more important than the other because, I think that at least for the STTR Programs, they are probably very much related.

Mr. BENTSEN. Let me ask, There are a number of participants in my district and in the greater Houston area — and I think that is great — there are a number that have companies, small companies, that have received a number of grants, which I think is also great.

We are looking in this Committee at various changes in other SBA Programs, for instance, the 8(a) Program and Minority and Small Disadvantaged Business Set-Aside Programs. We are talking about the ideas of graduation.

We are talking about moving somebody out of the program over time, with the idea that under 8(a), you have got assistance to get in so you can get some contracting experience and learn the business, make the contacts, and then could graduate and go on and be successful at business without having the assistance from the Government.

Does this program provide for that, or is it something that we ought to consider for this program?

Mr. HILL. The SBIR and the STTR Program are distinct from that kind of program. They are basically and simply a set-aside program for small business research and development firms. There is no graduation or certification to have a threshold to get into the program.

Mr. BENTSEN. Does anyone else have a comment on that? I mean, should we consider this? In the same context when we think about 8(a) if this is one set-aside that is another set-aside?

Mr. HILL. With the success of the SBIR Program, and there is a 25 percent increase this year, and what we anticipate to be the success of the STTR Program, at this time we are not real anxious to make any changes.

Mr. MANZULLO. Let me?

Mr. BENTSEN. Sure.

Mr. MANZULLO. I want to wind this up. We have to leave here to vote in 5 minutes. I do not have any questions, but Congressman Poshard has a question. Are you almost at the end of yours?

Mr. BENTSEN. I am almost very much at the end.

Mr. MANZULLO. All right. Go ahead, please.

Mr. BENTSEN. I guess the question, though, is we are not necessarily talking apples and oranges if we are talking two types of set-asides. Should they all be considered? I mean, they may have different objectives, but should what is good for the goose not be good for the gander in regards, if we are making these changes?

Again, I am not trying to be critical of the SBIR Program and STTR Program. I think it sounds great. I think that is, again, where this country needs to be going. However, I have to balance these things out where, on the one hand, we are saying we need to limit these programs or do away with these programs, but on the others we do not. I guess my question is, should we look at these in the same context?

Mr. HILL. At this time, I would just argue that both SBIR and STTR are narrowly focused and allow small business to get a part of the Federal R&D that prior to 1982, with the creation of SBIR, was not available. It is narrowly focused on research and development firms, whereas the other SBA Programs are broadly focused on all sectors.

Mr. BENTSEN. Thank you.

Mr. MANZULLO. Mr. Poshard?

Mr. POSHARD. Thank you, Mr. Chairman.

I just would ask Mr. Hill in reference to the need expressed by Mr. Risser, the need for getting rid or changing the regulatory atmosphere with respect to the investment of angel capital in this whole technology transfer system. I know you folks have been working on that.

If you could provide me or provide the Committee short of a listing of the different approaches you are taking toward changing that, I would really appreciate it. I am very much interested in that. I would like to draft some legislation, if need be, to change that. If it is something that is done in-house, then all the better. I would be interested in knowing how you are approaching that.

Mr. HILL. I would be happy to provide that to you.

Mr. POSHARD. Mr. Hill I would ask you this question also. Just briefly, what are the geographical distributions of the STTR awards compared to the SBIR? Any general comment you can make to that?

Mr. HILL. Again, it is early and we are just now collecting data. We think we are seeing a little more of a distribution geographically, especially in the Midwest; but again, our data is very preliminary at this time.

Mr. POSHARD. No pattern has developed at this point in time geographically?

Mr. HILL. Not that we have verified at this point.

Mr. POSHARD. Thank you very much.

Thank you, Mr. Chairman.

Mr. MANZULLO. I have one question. The Midwest is the appropriate area to send those funds, right, Mr. Poshard?

Mr. MANZULLO. He represents the bottom of the State of Illinois, and I represent the top.

Mr. Hill, how many people in the SBA are involved in the administration of these programs?

Mr. HILL. For SBIR and STTR, there is a seven-person staff that I head up.

Mr. MANZULLO. That answers my question. Obviously, if the two programs were merged, you would probably still have the same number of employees?

Mr. HILL. That would not have any effect on the level of the staffing.

Mr. MANZULLO. Well, we are at the end of our time. We have to go vote on the floor.

Steve?

Mr. ZYLSTRA. Mr. Chairman, could I offer just one final comment on Representative Bentsen's question?

Mr. ZYLSTRA. I do not think that what is good for the goose is necessarily good for the gander in this case. I would suggest that at least the SBIR Program is probably one of the most successful programs the Government has ever engaged in, and so I think you have to look at the merits of the program as you move forward.

Mr. MANZULLO. Thank you very much. This Committee meeting is adjourned.

[Whereupon, at 11:40 a.m., the Committee was adjourned, subject to the call of the chair.]

APPENDIX

STATEMENT OF FLOYD H. FLAKE BEFORE THE HOUSE
COMMITTEE ON SMALL BUSINESS
MARCH 6, 1996

CHAIRWOMAN MEYERS, I APPRECIATE THE OPPORTUNITY TO DISCUSS TODAY THE SMALL BUSINESS INNOVATION RESEARCH PROGRAM (SBIR) AND THE SMALL BUSINESS TECHNOLOGY TRANSFER PROGRAM (STTR). AS WE HAVE LEARNED, SMALL BUSINESSES PRODUCE TWO AND ONE-HALF AS MANY INNOVATIONS PER EMPLOYEE AS DO LARGE FIRMS. GIVEN THIS FACT, THE STTR AND SBIR PROGRAM'S EMPHASIS ON INVOLVING SMALL BUSINESSES IN FEDERAL RESEARCH AND DEVELOPMENT IS AN EXCELLENT WAY TO INSURE THAT OUR COUNTRY REMAINS ON THE CUTTING EDGE OF TECHNOLOGICAL INNOVATION, WHILE WE ALSO GRANT SMALL BUSINESSES THE OPPORTUNITY TO COMMERCIALIZE INNOVATIONS. THE SUCCESS OF THE STTR AND SBIR PROGRAMS PROVES THAT GOVERNMENT CAN PLAY A BENEFICIAL ROLE IN BUSINESS DEVELOPMENT.

IN OUR TECHNOLOGICALLY-DRIVEN ECONOMY, SMALL BUSINESSES WILL NEED TO BE KNOWLEDGEABLE OF THE MOST RECENT TECHNOLOGICAL INNOVATIONS IN ORDER TO REMAIN COMPETITIVE. NEW TECHNOLOGIES OFFER SMALL BUSINESSES ACCESS TO NEW MARKETS AND OPPORTUNITIES TO INCREASE

THE EFFICIENCY OF THEIR BUSINESSES PRACTICES. THE GOVERNMENT ALSO HAS A ROLE TO PLAY IN THIS NEW ECONOMY. FEDERAL AGENCIES WHICH CONDUCT TECHNOLOGICAL RESEARCH MUST ALSO EFFECTIVELY MARKET ITS FINDINGS IN THE PRIVATE SECTOR TO INSURE THEIR EFFECTIVENESS. THE SBIR AND STTR ARE PROGRAMS WHICH ENCOURAGE COLLABORATION BETWEEN THOSE WHO CONDUCT RESEARCH FOR FEDERAL AGENCIES AND UNIVERSITIES AND THOSE WHO CAN PUT THE PRODUCTS TO PRACTICAL USE IN THE MARKETPLACE. THIS TYPE OF PUBLIC/PRIVATE COLLABORATION IS BENEFICIAL TO BOTH THE SMALL BUSINESSES INVOLVED AND THE U.S. ECONOMY.

IN SUMMARY, I WOULD LIKE TO THANK THE WITNESSES FOR TAKING THE TIME TO SHARE WITH US THE MERITS AND CHALLENGES OF THE SBIR AND STTR PROGRAM. I LOOK FORWARD TO DISCUSSING HOW WE CAN IMPROVE THE STTR AND SBIR PROGRAM TO MAKE IT THE BEST BUSINESS AND RESEARCH DEVELOPMENT TOOL POSSIBLE.

COMMITTEE ON SMALL BUSINESS
UNITED STATES HOUSE OF REPRESENTATIVES

FULL COMMITTEE HEARING REGARDING THE REAUTHORIZATION OF THE STTR AND SBIR PROGRAMS

March 6, 1996

Opening Statement of Congressman Glenn Poshard

Mister Chairman, thank you for holding this hearing on the reauthorization of the Small Business Technology Transfer program (STTR) and the Small Business Innovation Research program (SBIR). By all accounts, these programs have fulfilled their missions of stimulating technological innovation. Their success has not just been a boon for small business, but for the entire American economy. While it is too early to know the economic impact of STTR, the SBIR program, conceived of in 1977 and implemented in 1982, has generated billions of dollars in innovative development while also creating jobs by linking small businesses with research and development funds from federal agencies. Ranking Member LaFalce deserves much of the credit for both of these programs, and I would like to thank him for his leadership.

As many of you know, the STTR program is especially dear to me. In 1992, with the help of then Chairman LaFalce and then Subcommittee Chairman Skelton, I saw the need to supplement the already successful SBIR program by tapping into the vast resources of innovation that exist at our universities and nonprofit institutions. The United States has long been the world's research leader, but has been less successful in transforming discoveries into marketable products and permitting its top researchers the freedom to pursue commercial projects. The STTR program was designed to fill this void by awarding funds to small businesses and researchers at universities and nonprofit institutions that allow them to work in concert. The SBIR program has tended to fund our nation's major research corridors in the Silicon Valley and around Route 128 in Massachusetts. The STTR program has enabled the rest of the country to get involved. In 1994, thirty-two states and the District of Columbia were represented by research institutions in the STTR program. In my state of Illinois, five research centers are participating, including Southern Illinois University, the University of Illinois, and Northwestern University.

In 1994, STTR's first year, the five participating federal agencies, the Department of Defense (DOE), the Department of Energy (DOE), the Department of Health and Human Services (HHS), NASA, and the National Science Foundation (NIH), provided almost $19 million to 181 different firms. Universities and Research Institutions received over $7.5 million dollars of this total. To me, this indicates that a vital need has been addressed. And perhaps most importantly, these programs have been very hard to criticize. For example, the DOD is the largest participating federal agency in the STTR program, and in written testimony for this hearing it has endorsed it for reauthorization. The General Accounting Office (GAO) has emphasized the quality of the research being conducted in both programs, using such descriptives as "excellent" and "'cutting edge'" in reference to STTR. Moreover, it should be clear after listening to today's testimony from those intimately involved in these programs that STTR and SBIR are not only getting products out of the laboratory, but into the marketplace.

Mister Chairman, I would again like to thank you for your attention to these important programs, and I extend a warm greeting to our esteemed panel. Their time and expertise are greatly appreciated, and I look forward to their testimony.

Committee on Small Business
U.S. House of Representatives

Hearing

TO ASSESS THE SMALL BUSINESS TECHNOLOGY TRANSFER PROGRAM AND THE SMALL BUSINESS INNOVATION RESEARCH PROGRAM

March 6, 1996
10:00 a.m.

OPENING STATEMENT

Rep. Peter G. Torkildsen (R. MA)

Today's hearing highlights two federal government high technology programs which utilize the tremendous creativity and flexibility of small business to promote commercialization of innovations derived from federal research and development. The programs I'm referring to are the Small Business Innovation Research Program, or SBIR, established in 1982, and the Small Business Technology Transfer Program, or STTR, a three-year pilot program which began in 1994.

The SBIR and STTR Programs give small businesses an opportunity to compete for a very small portion of federal agencies' research and development budgets. Both programs are highly competitive and have demonstrated the high caliber of proposals brought to the table by small entrepreneurial companies.

Under SBIR, we are seeing firms which have completed Phase II projects achieve a 24% rate of commercialization after 4 years. In the first two years of the STTR Program, more than 430 Phase I awards have been made valued at $40.5 million and 22 Phase II awards have been issued at $10.7 million.

To bring those numbers a little closer to home, for example, in Massachusetts about 600 SBIR awards were made in 1994 alone for close to $89 million and 25 STTR awards for almost $2.5 million.

The two programs share a common three-stage process designed to enable small firms to identify and nurture promising innovations towards the marketplace. The one way the two programs differ is that a small business must collaborate with a nonprofit research institution, such as a university or Federally Funded Research and Development Center to be eligible for an STTR award.

Today's hearing will focus on the STTR Program, which unless reauthorized, will terminate on September 30th of this year.
The Committee must ask is a difficult question today -- whether there is continued need for both the STTR and SBIR Programs given their

similarity. The hearing will also consider recommendations for making the programs more effective in attaining their goals.

We are fortunate to have with us five representatives from the small business community who have been involved in the SBIR and STTR Program; Mr. Daniel Hill, Assistant Administrator for Technology Programs at the Small Business Administration; and Mr. Victor Rezendes, Director of Energy and Science Issues of the U.S. General Accounting Office.

With that I conclude my opening statement and I will yield to my colleague Mr. LaFalce for any opening statement he may wish to make.

Written Statement For The 104th Congress, Committee on Small Business, Regarding the SBIR and STTR Programs.

By

Richard W. Carroll

President

Digital System Resources, Inc.

March 3, 1996

As President of Digital System Resources, Inc. (DSR) of Fairfax, Virginia I am pleased to provide the committee with DSR's experiences with the Small Business Innovation Research (SBIR) Program and the Small Business Technology Transfer (STTR) Program. DSR's experience with the SBIR program began in October of 1987 as we began to prepare our first two phase-one SBIR proposals for submission to the US Navy. At that time the SBIR program was new both to our company and to our customers. However, the topics published in the solicitation sparked our interest and we made our first investment in the program by writing two twenty-five page proposals containing our ideas in two differing topic areas. DSR was selected on both these proposals and thus began our involvement with the SBIR program. Since that time, we have submitted numerous phase one, two, and three SBIR proposals to agencies of the U.S. government. We have a number of successes with commercialization of our SBIR technologies resulting in phase-three contracts totaling over 65 million dollars. The future promises continued successes as our technologies reach maturity and production begins. When the STTR program issued its first request for proposals in 1994 we bid on four topics and succeeded in being awarded one of them. That winning proposal sought to identify innovations in antenna design and subsequent processing improvements to provide a quick reaction capability for U.S. surface ships. Currently DSR has ongoing activities in the SBIR program for phases one, two, and three, and recently, we have submitted a proposal for a phase-two STTR which we hope to see awarded early this year. During our involvement with the SBIR and STTR programs during the past eight years, we have gained insights into many very interesting facets of these programs. I feel very fortunate to have this opportunity to share these insights and experiences with this committee.

First and foremost, it is my opinion that within the defense sector today the SBIR and STTR Programs offer the only viable pathway for small businesses to make significant advanced technology contributions to our Country's aging weapon systems. This has come about due to both significant changes which have occurred in the defense sector marketplace and the unique and effective structure of the SBIR and STTR programs in fostering small business innovative technology development while also providing the necessary protection and opportunity for incorporation into the defense market place.

Several very significant changes in the defense market place have had an enormous negative impact on high technology small businesses. We have seen the US defense budget shrink substantially. As a result of this, and in an effort to maintain their highly skilled work force, we have seen large defense contractors substantially reduce their high technology subcontracting activities while they aggressively compete for even the smallest pots of advanced technology research and development dollars. Furthermore we have witnessed an unprecedented number of acquisitions and mergers designed both to corner strategic markets and to achieve economies of scale. These changes have created a defense sector contractor environment characterized by a relatively few very large defense contractors with significant financial, technical, and political might and each with their respective strategic market place dominance. As a result of these changes, our company has had to find alternatives to subcontracts from large business in order to continue to offer our advanced technology solutions to the Department of Defense (DoD). The SBIR and STTR Programs have become our best and most effective alternative.

One trend in the defense marketplace has had a very positive impact on small business, and this has been a major factor in our company's success in the SBIR Program. Recognizing the need to affordably modernize our aging legacy weapon systems with the latest in technology advances, the DoD has removed many of its unique military requirements, thus opening their door to innovative solutions derived from commercial-off-the-shelf (COTS) components. No longer does a business need to be a manufacturer of complex military equipment in order to provide the DoD with effective solutions to many of their complex weapon system problems. Small business may in fact be in the best position to offer the DoD many of these COTS-type solutions because of its ability to reduce costs and rapidly adapt to the changing technologies and business environments.

In summary, the environment in the defense sector marketplace has changed in ways that significantly limits small businesses access to a marketplace which is in more need then ever of the cost-effective and innovative solutions that small businesses can best provide. The SBIR and STTR programs have a unique and effective structure for introducing advanced technology from small business into the defense marketplace. These programs offer a "fly before you buy" approach which gives small businesses adequate funds to provide an advanced technology demonstration of their concepts before any commitment to incorporate the technology into the weapon system. In addition they provide adequate protection and opportunity for follow-on procurements to ensure enthusiastic and motivated small business participation.

During our company's participation in the SBIR Program we have reached a successful phase 3 "commercialization" on a number of occasions with several advanced technologies. Perhaps the best illustration of this success is an SBIR activity now called the Multipurpose Processor (MPP). The MPP SBIR activity began in 1991 with two SBIR awards given to our company which dealt with the incorporation of COTS technology into submarine combat systems. One dealt with the migration of complex legacy software and the other addressed the identification of advanced COTS architectures which could support the needs of submarine combat systems. Over the course of 5 years and 4 competitions (phase 1 and phase 2 on both topics) these efforts have evolved into a COTS-based submarine sonar processor which has been selected as the cornerstone of the sonar upgrades for the existing SSN 688, 688I, and SSBN 726 (Trident) submarines. Many key technologies have been provided to the submarine fleet through the development of the MPP. These include a middleware technology for the uncoupling of applications software from processing hardware, a software architecture designed to support reuse, substantial libraries of reusable software objects, and a water-cooled enclosure designed to make the best use of commercially available hardware while still providing the necessary protection for the submarine environment.

Using MPP technology as a foundation, the Navy has re-planned its modernization of the U.S. submarine fleet sonar processing to occur much earlier than originally scheduled. Through a four-year, phased implementation program called the Acoustic Rapid COTS Insertion Program (ARCI), the Navy will capitalize on the MPP to rapidly deliver major sonar capability improvements in all SSN 688, 688I, and SSBN 726 (Trident) submarines. In a recent correspondence to Senator John Warner and Congressman Tom Davis, Captain Gordon Peterson, US Navy Director for Congressional and Public Affairs, cited the following "lessons learned" related to the SBIR and MPP Programs:

"The SBIR Program:

- Allows small business direct access to solving the Navy's technology problems through a competitive process.
- Provides insight to Navy SBIR topic sponsors on innovative solutions developed by other than the large business base.
- Offers streamlined acquisition and procurement process to mature innovative ideas rapidly.
- Allows small business an opportunity to perform under direct government direction.
- Presents (the) Navy with an affordable, low risk opportunity to work with and evaluate the capabilities and performance of small businesses.

- Provides a vehicle for innovative small business to build productive and long lasting relationships with large corporations acting as system integrators.

The MPP Program:

- Demonstrated that in specific technical niche areas, small business can perform on par and at lower cost than big business.
- Demonstrated that today's low cost Commercial Off The Shelf (COTS) technology allows small business to have equal footing with big business.
- Proved once again that a commitment to COTS and an Open Systems Architecture approach can be successful.
- Validated software development processes for the migration of legacy system software and the incorporation of advanced COTS processing capabilities.
- (Demonstrated that) through the use of COTS hardware and software products, the productivity of development, integration, and test is substantially higher than previous industry averages."

These observations clearly indicate that the Navy places significant value on the contributions that the SBIR Program and the MPP SBIR Program are making to the U.S. submarine fleet.

The MPP SBIR Program was managed and implemented as a cooperative effort by the New Attack Submarine Program and the Submarine Combat Systems Program. By following the SBIR procurement process the MPP program took on characteristics reflective of the visions, goals and actions identified by Mrs. Colleen A. Preston in her Statement on Acquisition Reform presented to the Committee on National Security on August 2, 1995. DoD's reengineered acquisition system envisions the DoD as the world's smartest buyer, where "...there are incentives for personnel to innovate and to manage risk rather than avoid it; and where maximum advantage is taken of emerging technologies...". The SBIR program is designed to innovate and take advantage of emerging technologies.

By forming a partnership between small business and DoD technical representatives, innovation can and does occur, and through this partnership such innovation can make significant contributions to meeting warfighter needs.

On the MPP program the Navy technical representatives from both the Naval Sea Systems Command and the Naval Undersea Warfare Center formed an Integrated Product and Process Team with our company and our subcontractors. These government agents were value-added team participants in finding innovative solutions to making the latest state-of-the-art commercial technologies available to our aging submarine fleet. Through the phase 1, phase 2, and subsequently the phase 3 process, a pilot program was initiated to test the ability of COTS components to meet necessary submarine environmental and performance requirements.

By taking a streamlining approach, the phase 3 acquisition removed military specifications and standards and made effective use of performance specifications. Furthermore, our company was encouraged to procure best-value goods and services to support our needs for design services and commercial components comprising the MPP and did so with excellent results. In general, the overall management approach to the MPP SBIR Program has been successful because we had known and stable requirements, and we have empowered customer and developer personnel acting as an Integrated Product and Process Team with clear and decisive project leadership. The SBIR Program was instrumental in making this opportunity available to our small business and in fostering the partnership with our customer that is necessary to its ultimate success.

Our experience in the STTR program to date has been very similar to that experienced in the SBIR program. We were able to come to a successful business arrangement with our research partner, Duke University, and expect to derive significant benefit from their activities as our STTR activity matures. Our phase two proposal already incorporates a phase three funding activity. The characteristics of our partnership are that Duke has a basic research orientation whereas DSR is focused on applying advanced technology to the marketplace, whether that technology originates in Duke University or at our company. This partnership brings together the needed partners to stimulate the transition of more basic research from the university environment into the commercial marketplace. Our relationship with Duke remains a positive experience with the added benefit of giving us a proven source of well-trained professionals for our company and their graduates a successful high technology small business employment opportunity.

I consider the STTR program a significant complement to the SBIR program in that it generally involves more basic research while still providing all the advantages that come from the SBIR program. The STTR program should be reauthorized and allowed to mature to its natural position along side the already successful SBIR program.

PRESENTATION BY DR. BRIAN CLEVINGER TO THE U.S. HOUSE OF REPRESENTATIVES COMMITTEE ON SMALL BUSINESS

Re: STTR Program
Date: March 6, 1996

OVERVIEW

My professional career has given me a clear view of the importance of STTR and SBIR grant programs. I have seen the impact of these grants from the perspective of a university professor, technology transfer professional, venture capitalist and CEO of a biotech start-up company. From my perspective, I feel strongly that these programs address the critical national need for fostering the transfer of technology from universities into new companies. As I will describe, the STTR program has a special role that is quite separate and vital to the technology transfer process which is not addressed by the SBIR program. Given that technological innovation is one of this country's greatest strengths, these programs help harness that strength and use it to create high paying jobs, fuel new innovation and keep America at the forefront of technology development.

BACKGROUND

From 1980 to 1987, I was an NIH funded assistant/associate professor at Washington University in St. Louis. During that time, I was involved in basic research on the regulation of immune responses. I worked on technology (monoclonal antibody production) that was part of the biotechnology explosion that began in the late 1970's. In 1987, I left the full time employment of the University and joined the A/W Company, a partnership between Washington University in St. Louis and Alafi Capital, a California based venture capital fund. The purpose of the partnership was to commercialize technology originating from the University. From 1987 until 1993, I worked very closely with innovative university professors, university technology transfer professionals as well as with the venture capitalists funding early stage technology companies. During a seven year period, the partnership funded the development of six new companies, all based on technology developed by university faculty. My role was to perform due diligence on company formation including detailed analyses of the technology, patents and commercial opportunities. I also served as initial management for the start-up firms and helped find and hire the management teams. For some of these companies, I helped write SBIR grants, two of which were funded.

The last company formed from the A/W partnership was MEGAN Animal Health; a company developing vaccine technology for animals and humans. As an immunologist with considerable start-up experience, I was given the opportunity to manage this company from its beginning 2 1/2 years ago. In addition to the sizable investment by Alafi Capital and a major pharmaceutical company, our company has successfully competed for 2 STTR grants from the NIH with one additional grant pending. We have written 3 SBIR grants, one is pending, two were rejected.

THE CRITICAL DIFFERENCE

Why has MEGAN successfully competed for STTR grants and not for SBIRs? The reason is that the PI for an SBIR must be substantially employed by the small business submitting the proposal; for the STTR, the PI must be an employee of a nonprofit research institution. This is a critical difference because the scientists that review these grants are the same that review other types of government grants such as individual RO1 awards from the NIH. These grants are highly competitive and funding depends heavily on the resume and track record of the principal investigator. Therefore, to successfully obtain an SBIR or STTR, the application must have a PI with extensive credentials. Most start-ups cannot afford such individuals in their early stages. The cost of one high profile scientist can easily fund 2 or 3 more junior scientists. In MEGAN's case, we utilize Dr. Roy Curtiss, the scientific founder of MEGAN and a full-time faculty member of Washington University, as the PI for our STTR grants. Our SBIR grants were written with a great deal of input from Dr. Curtiss but the PIs were one of our young scientists. None of our SBIR's have been funded, all of our STTR's have been funded.

DIFFERENT PERSPECTIVES

Lets look at this issue from a number of standpoints.

University

A university wants a mechanism for faculty to commercialize technology but does not want to lose the faculty member to the business involved. This can be a very significant drain on the intellectual resources of the university community. The STTR program allows for professors to take part in the development of their ideas without having to leave the university. The SBIR program is also a potential transfer mechanism but only allows the faculty member to work with companies that have specific expertise and documented track records in the same technological area. This is often a very great limitation because very few, if any, companies have expertise in cutting edge technology found in universities.

Faculty

Naturally, at non-profit institutions, researchers want to see their ideas benefit mankind and often this requires commercialization. Thus, the temptation to move with their ideas is very strong. The problem is that moving to a small business is a high risk proposition. Again, the STTR program allows the investigator to stay in the university with the attendant benefits and still allow his/her ideas to be commercialized.

The Small Business

Many small technology companies can not afford high priced scientists as well as experienced management. The trade off that is often made is that the scientist is asked to run the company as well. This rarely works in our experience. It is far better to hire an outstanding manager with good young technologists than to hire a high-priced scientist who performs duties for which he/she is not trained. The experience of most venture capital investors is that good management is always a requirement for a new company. Scientific expertise can be outsourced.

SUMMARY

Both the SBIR and STTR programs have roles in technology development and transfer. In my judgment, it would be hard to justify one over the other. They are different mechanisms to achieve the end of developing new technologies and commercializing them profitably. Many studies have shown that new companies create more jobs than established ones. However, the success of new companies is a very tenuous proposition and needs all the help that society can give them. I hope that this Committee will continue its support for the STTR and SBIR programs. They are both important and effective.

U.S. SMALL BUSINESS ADMINISTRATION
WASHINGTON, D.C. 20416

TESTIMONY OF

DANIEL O. HILL

ASSISTANT ADMINISTRATOR FOR TECHNOLOGY

BEFORE

COMMITTEE ON SMALL BUSINESS

U. S. HOUSE OF REPRESENTATIVES

MARCH 6, 1996

Good morning Madame Chairman and distinguished members of the Committee. It is my pleasure to appear before the Committee on Small Business to discuss two SBA technology programs: the Small Business Innovation Research (SBIR) program and the Small Business Technology Transfer (STTR) program.

To begin, I would like to commend the Committee for your support and encouragement in creating and sustaining these two important programs. As you know, small business is an important sector of our national economy employing 54 percent of the American work force. Studies show that small businesses are our leading source of innovations and that small firms produce twice as many innovations per employee as large firms. These two programs are vital to small businesses desiring to participate in U.S. Government research and development efforts. The SBIR and the STTR programs provide the highest quality research for the U.S. Government and enable small businesses to grow, mature and create jobs for Americans.

THE SBIR PROGRAM

The Small Business Innovation Act of 1982 established the Small Business Innovation Research (SBIR) program. This program, created by the House Small Business Committee, was intended to ensure that small businesses would be able to participate in federal research and development projects. Beginning with hearings as early as 1978, it was clear that federal agencies did not actively solicit involvement from the small business community in their research and development procurements. With support from the Small Business Administration and the 1980 White House Conference on Small Business, SBIR became a reality in 1982 with the passage of the Act. The program mandates that each federal agency with an extramural research and research and development budget in excess of $100 million must designate a certain percentage of this budget for small businesses. Currently, there are eleven federal agencies participating in the program plus the U.S. Small Business Administration playing an important policy/oversight role. The eleven agencies are the Departments of Agriculture, Commerce, Defense, Education, Health and Human Services, Transportation, and Energy and the Environmental Protection Agency, National Aeronautics and Space Administration, National Science Foundation, and the Nuclear Regulatory Commission[1].

At the beginning, the SBIR set-aside percentage was 0.2% with a legislated growth to 1.25% in 1987 that continued until 1992. On October 28, 1992, the program was reauthorized to the year 2000 and the Committee maintained the growth rate directing that the percentage grow each year to an eventual 2.5% in FY 1997, maintaining that level to the year 2000.

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[1] The Nuclear Regulatory Commission has notified the SBA that their extramural research and development funding will be significantly below the $100 million threshold where participation is required and they intend to gradually phase out of the SBIR program.

The Act established a three-phase structure:

- Phase I: Awards of up to $100,000 are funded for six months for research projects to evaluate the scientific and technical merit and feasibility of an idea.

- Phase II: Funds Phase I projects with the most potential to further develop the proposed idea. Phase II funding is for one or two years, and most awards are $750,000 or less.

- Phase III: No SBIR funds may be used in Phase III. Private sector investment and support brings an innovation to market, and, if appropriate, Phase III may involve follow-up production contracts issued by a federal agency for future use by the government.

Since its inception in FY 1983, the program has proven popular with the small business community. Small hi-tech firms have submitted over 220,000 proposals which have resulted in over 33,000 awards worth more than $4 billion. The increasing number of commercial sales successes associated with the program have come from a wide range of technologies and industries, from laser manufacture to medical research, and from robotics to military decision making, to name a few. The new products and techniques emerging from SBIR awards are helping maintain and improve

America's competitiveness worldwide. I have attached a table detailing our latest figures for SBIR awards for each agency and for each state.

An excellent example of the importance of the SBIR program can be seen in the success of one small business, Cavitation-Control Technology, Inc. Cavitation-Control Technology, Inc. (Cav-Con) is located in Farmington, Connecticut. Headed by its founder and president Dr. Joseph S. D'Arrigo, the company's principal business is in the medical research and development area.

Between 1987 and 1993, Cav-Con received two SBIR Phase I awards and a Phase II award that, together, totalled $600,000 from the Department of Health and Human Services (HHS). These Federal funds allowed Cav-Con to expand its medical research and development efforts to include an extensive pre-clinical development program for cancer diagnosis and therapy. The numerous journal publications that resulted from these HHS-supported studies have, in turn, directly assisted in attracting over $1.1 million in private sector funding from 1991 to mid-1995. The firm's management confirms that 93 percent of these private-sector funds since 1991 are from pharmaceutical companies headquartered overseas, and essentially all such private funds are expended within the United States in support of Cav-Con's ongoing pre-clinical development work.

The SBIR program is alive and well. As one indicator of its value, the SBA has studied commercialization rates for SBIR awards. Commercialization for SBIR purposes means the development of a specific product that can be brought to market or used by the government. Our studies show that firms which have completed a Phase II SBIR project achieve approximately a 24% rate of commercialization after four years. The percentage is close to 40% when we consider products that are the result of more than one contributory SBIR project. Quite clearly, this is a high percentage and demonstrates the terrific value of this small business program. Given the number of awards, and value of the work, the SBA recommends the program be continued with no changes at the current time.

THE STTR PROGRAM

At the time of the 1992 reauthorization of the SBIR program, the House Small Business Committee designed a pilot program called the Small Business Technology Transfer (STTR) program. Despite the successes of the SBIR program, the Committee felt that more could be done, especially to link small businesses with creative ideas at universities, non-profit scientific and educational institutions, and federal laboratories.

The Small Business Research and Development Enhancement Act of 1992 directed that federal agencies which have an extramural research, research and development budget in excess of $1 billion must designate for technology transfer a certain percentage of this budget for small businesses. For the three year pilot program (1994, 1995, and 1996) there are five federal departments and agencies participating in the program: Defense, Energy, Health and Human Services, National Aeronautics and Space Administration, and the National Science Foundation. Again, the U.S. Small Business Administration plays a significant policy and oversight role. The Act stipulated that the percentage of each agency's extramural research and development budget to be set-aside for small businesses would be 0.05% in FY 1994, 0.1% in FY 1995, and 0.15% in FY 1996.

The Act also established a three phase program similar to the SBIR program with a few minor differences. Phase I is generally for a one year period as opposed to six months for SBIR, and the Phase II award level is set at $500,000 instead of $750,000 for Phase II in SBIR.

STTR is unique in that it involves cooperative research and development performed jointly by a small business and a non-profit research institution. Most universities and colleges, non-profit research centers, and government-owned, company-operated laboratories are eligible.

During the first two years of the pilot program, 436 Phase I awards valued at $40.5 million were issued and 22 Phase II awards were issued valued at $10.7 million. I have attached a table detailing our latest figures for SBIR awards for each agency and each state.

In October of 1994, the Department of the Navy awarded an STTR Phase I project to Advanced Device Technologies, Inc. to develop transistor technology to save power, and lead to longer battery life, in wireless communications applications. Because of the Navy STTR award, and his partnership with the University of Virginia on this project, Dr. William Peatman, President of Advanced Device Technologies, Inc., secured additional funding from the Virginia Center for Innovative Technology. Dr. Peatman emphasizes this additional support would not have been forthcoming if he had not entered into a partnership with the University of Virginia as part of the Navy STTR award. Clearly, the STTR premise of linking universities with small businesses was beneficial in this instance. Dr. Peatman has progressed in his research and has won a Phase II award from the Navy worth $500,000.

Because the program is new, we are currently at the Phase I or the beginning of the Phase II cycle of each project and it is too early to begin commercialization studies. However, given our conversations with the federal agencies involved in the program, we anticipate a success rate similar to that demonstrated in the SBIR program over the years. In their January 1996 study, "Federal

Research: Preliminary Information on the Small Business Technology Transfer Program," the General Accounting Office (GAO) generally supported this view. In their report[2], they say:

> "In general, technical evaluations of STTR proposals showed favorable views of the quality of proposed research and commercial potential. For research quality, the evaluations (1) awarded perfect scores to many proposals, (2) rated proposals among the top 10 percent of research in certain agencies, (3) described some proposals as "cutting edge," and (4) generally found the quality to be excellent. For commercial potential, the evaluations arrived at similarly favorable conclusions, although in some cases they were somewhat more cautious because of the newness of the program or the risk associated with the proposals."

SBA recommends to the Committee that the STTR program be reauthorized until September 30, 2000 at the FY 1996 levels. Although we believe it will be highly successful, because the program is new, we do not, at this time, recommend any other changes. By the time it becomes necessary to reauthorize the program in the year 2000, we will have a significant number of projects completed through the full cycle of three phases. The SBA's position is that it is a valuable program that needs a sufficient start-up period before any changes are made.

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[2] "Federal Research: Preliminary Information on the Small Business Technology Transfer Program," United States General Accounting Office, GAO/RCED-96-19, January 1996, page 26.

THE MARCH 1995 GAO REPORT

In their March 1995 report, "Federal Research: Interim Report on the Small Business Innovation Research Program,"[3] the GAO recommended a number of actions to reduce the risk of duplicate funding of similar research. The SBA generally agreed with the GAO and issued a modification to its policy directive on July 26, 1995 answering the GAO's concerns. We clarified and further defined the role of the principal investigator, refined the certification of possible duplication statement and added further clarification of the similar award definition.

To fully comply with the GAO recommendations, the SBA also began work on developing a computer system that would allow all agencies, in a real-time sense, access to information on awards being made by other agencies. The programming for this system is now complete and we are currently in the final phases of procuring the computer equipment. We intend to have the system up and functioning by the end of FY 1996.

OTHER SBA INITIATIVES

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[3] "Federal Research: Interim Report on the Small Business Innovation Research Program," U.S. General Accounting Office, GAO/RCED-95-59, page 33.

The SBA plays an important role in both the SBIR and STTR programs. The participating federal agencies look to the SBA for policy and program guidance. The SBA also monitors closely the various agencies to ensure that they are in compliance with the two Acts and to report to the Congress on their implementation. In the last six months, SBA has undertaken a number of initiatives to focus its limited resources more effectively in order to enhance its role and responsibilities for both programs. We have initiated SBA quarterly interagency program managers meetings that will both resolve policy differences as well as serve as a forum for discussion of different agency approaches to the two programs.

We have become more involved in outreach and marketing efforts by formally joining as a cosponsor of the already highly successful national conferences run by the Department of Defense and the National Science Foundation. Prior to this, we only provided a speaker for one or two panels. We are now full and equal cosponsors of these important national events.

We have begun work on a series of national "mini" conferences which we hope to conduct this year in conjunction with our offices of Women's Business Ownership and Native American Affairs. We have begun work to involve our Service Corps of Retired Executives and our Small Business Development Centers in our marketing and outreach efforts. Finally, we have begun work with our Small Business Investment Companies staff and SBA's Office of Advocacy to investigate funding opportunities for SBIR and STTR awardees as they enter Phase III of their projects.

Clearly our new emphasis is on mainstreaming the program into all of the other SBA programs and to establish our leadership in the interagency process.

CONCLUSION

The SBIR and STTR programs are vital to the small business community and to our nation's research agenda. This fiscal year, approximately $930 million under SBIR and $50 million under STTR will be awarded to small business research and development firms. Without these valuable programs, it is doubtful that this level of participation and opportunity would exist for these firms and our national research programs would not receive the benefit of these highly innovative companies. These programs have earned high marks for their level of quality, that in most cases, is higher than other federal research and development projects. These programs are not giveaways, but rather highly competitive awards for work that the federal government needs. They do not add cost to the federal budget but serve to ensure that high-quality small business talent is able to participate in federal research and development efforts. Further, as a result of these programs, there is a flow of innovative new products and services to the American marketplace. For these reasons, the SBA strongly urges the

Committee to continue both programs at least at their current levels.

Thank you for inviting me to share with you the views of the SBA on these two vital programs and I will be happy to answer any questions you might have.

Fiscal Year 1994 Agency Obligations - SBIR

Agency	Dollars Obligated
Department of Agriculture	$7,166,000
Department of Commerce	$3,718,000
Department of Defense	$354,189,000
Department of Energy	$53,147,000
Department of Education	$2,643,000
Department of Health and Human Services	$133,276,000
Department of Transportation	$7,489,000
Environmental Protection Agency	$4,855,000
NASA	$115,807,000
National Science Foundation	$34,071,000
Nuclear Regulatory Commission	$1,286,000

Small Business Administration
Office of Innovation, Research and Technology

Total SBIR Awards Awarded for Fiscal Year 94

State	Phase 1 Awards	Phase 1 $	Phase 2 Awards	Phase 2 $	Total Awards	Total $
	0	0	0	0	0	0
Alabama	58	4,142	14	6,903	72	11,045
Alaska	0	0	0	0	0	0
Arizona	43	2,697	18	7,251	61	9,948
Arkansas	0	0	2	714	2	714
California	757	54,575	229	100,037	986	154,612
Colorado	121	8,129	44	19,214	165	27,343
Connecticut	107	7,991	28	12,695	135	20,686
Delaware	14	1,054	4	1,658	18	2,712
District of Columbia	10	719	3	850	13	1,569
Florida	65	4,387	12	4,976	77	9,363
Georgia	20	1,462	7	2,254	27	3,716
Hawaii	13	875	3	1,281	16	2,156
Idaho	9	587	0	0	9	587
Illinois	33	2,368	13	4,183	46	6,551
Indiana	15	941	3	1,244	18	2,185
Iowa	4	245	0	0	4	245
Kansas	6	358	2	671	8	1,029
Kentucky	8	578	0	0	8	578
Louisiana	8	583	1	743	9	1,326
Maine	8	619	2	936	10	1,555
Maryland	150	10,651	54	21,838	204	32,489
Massachusetts	459	32,676	136	56,047	595	88,723
Michigan	57	4,125	16	7,242	73	11,367
Minnesota	57	4,059	11	4,224	68	8,283
Mississippi	1	50	1	180	2	230
Missouri	13	906	2	810	15	1,716
Montana	5	372	4	1,718	9	2,090
Nebraska	2	138	0	0	2	138
Nevada	4	260	1	300	5	560
New Hampshire	35	2,630	12	5,842	47	8,472
New Jersey	113	8,005	30	12,360	143	20,365
New Mexico	49	3,483	15	5,345	64	8,828
New York	151	10,722	38	16,531	189	27,253
North Carolina	40	2,854	14	5,896	54	8,750
North Dakota	3	175	0	0	3	175
Ohio	92	6,364	24	10,222	116	16,586
Oklahoma	5	337	1	499	6	836
Oregon	39	2,880	18	8,164	57	11,044
Pennsylvania	86	5,926	26	10,993	112	16,919
Puerto Rico	0	0	0	0	0	0
Rhode Island	7	480	2	1,222	9	1,702
South Carolina	4	234	0	0	4	234
South Dakota	1	49	0	0	1	49
Tennessee	30	2,120	16	6,343	46	8,463
Texas	99	6,898	31	12,683	130	19,581
Utah	29	2,079	9	3,233	38	5,312
Vermont	10	678	2	915	12	1,593
Virginia	160	11,690	57	23,811	217	35,501
Washington	60	4,166	26	10,930	86	15,096
West Virginia	0	0	0	0	0	0
Wisconsin	32	2,403	5	1,847	37	4,250
Wyoming	0	0	0	0	0	0

Note: All $ amounts in thousands

Small Business Administration
Office of Innovation, Research and Technology

Total STTR Awards Awarded for Fiscal Year 94

State	Phase 1 Awards	Phase 1 $	Phase 2 Awards	Phase 2 $	Total Awards	Total $
Alabama	2	196	0	0	2	196
Arizona	3	256	0	0	3	256
California	38	3,571	0	0	38	3,571
Colorado	4	497	0	0	4	497
Connecticut	9	819	0	0	9	819
Florida	4	309	0	0	4	309
Georgia	2	160	0	0	2	160
Idaho	2	194	0	0	2	194
Illinois	7	636	0	0	7	636
Indiana	2	160	0	0	2	160
Kansas	1	100	0	0	1	100
Louisiana	1	98	0	0	1	98
Maryland	8	717	0	0	8	717
Massachusetts	25	2,426	0	0	25	2,426
Michigan	3	290	0	0	3	290
Missouri	2	200	0	0	2	200
Nebraska	2	200	0	0	2	200
New Hampshire	4	357	0	0	4	357
New Jersey	7	613	0	0	7	613
New Mexico	4	395	0	0	4	395
New York	6	560	0	0	6	560
North Carolina	4	397	0	0	4	397
Ohio	11	1,057	0	0	11	1,057
Oregon	3	300	0	0	3	300
Pennsylvania	5	485	0	0	5	485
Tennessee	5	496	0	0	5	496
Texas	5	492	0	0	5	492
Utah	1	1,000	0	0	1	1,000
Virginia	10	969	0	0	10	969
Washington	3	298	0	0	3	298
Wisconsin	2	173	0	0	2	173

Note: All $ amounts in thousands

Fiscal Year 1994 Agency Obligations - STTR

Agency	Dollars Obligated
Department of Defense	$9,265,170
Department of Energy	$2,052,443
Department of Health and Human Services	$4,694,906
NASA	$1,775,000
National Science Foundation	$1,092,902

Testimony to be presented before the Committee on Small Business

March 6, 1996

John B. Phillips
Southern Illinois University
Carbondale, IL 62901-4409

I would like to thank the committee for this opportunity to comment on the Small Business Technology Transfer (STTR) and Small Business Innovation Research (SBIR) Programs.

During 1995, Southern Illinois University at Carbondale in collaboration with Zoex Corporation of Lincoln, Nebraska (a small business currently with two employees) received research funding through the STTR program of the National Science Foundation. I am the university collaborator involved in that project. This STTR funding was used to enhance an existing relationship between the university and the business. The goal of the STTR funded work was to develop an idea which originated in my laboratory into a commercial product to be sold by the business. This STTR funded collaboration has been very successful.

Briefly, the product developed by this collaboration is an instrument and method for chemical analysis of organic mixtures. The method, known as comprehensive two-dimensional gas chromatography, is a major advance over older techniques. Using it, we can make chemical measurements that can be done in no other way. For example, we can observe more than 6,000 individual chemical substances in gasoline. There are numerous potential applications, especially in environmental chemistry and the petroleum industry.

Federal funding for the research to develop this product has been very difficult to obtain. I have had support for other projects but only a small amount of NASA support and part of one small NSF grant were devoted to this project. The initial basic research on the technique was done without external support. Collaboration with the small business was established because the business owner recognized the commercial potential (which I hadn't seriously considered), offered to pay for patent applications, and committed the businesses resources in exchange for a license from the university.

When the STTR program at NSF was announced, I realized that it fit our situation exactly. It was specifically aimed toward collaborative development and commercialization of analytical instrumentation. We decide to prepare a jointly authored proposal. As it turned out, this was a very good decision because my other proposals to NSF and EPA were not funded. For a year, the university's share of the STTR collaboration was the only research funding that I had. I also decided that some concentrated effort on my part was needed to help get commercialization moving and so took a one year sabbatical leave, which was partially funded by the STTR grant, to work with Zoex and other collaborators.

Phase one of this STTR grant has been very successful. At the beginning of the year, we developed a new approach to the instrument design. A jointly authored patent application was filed. This new approach was taken through several design iterations and delivered to three customers for their evaluation. It is working well at all three sites and all three customers have indicated that they intend to order a second instrument. Total sales received or in process amount to more than twice the amount of the STTR funding. One of the early customers is the Centers for Disease Control. Our collaboration with CDC has resulted in an improved method for dioxin analysis that has the potential to save the government several million dollars in chemical analysis costs over the next few years. A second customer was Royal Dutch Shell, Amsterdam. This sale was an export which by itself brought in foreign exchange almost equal to the STTR phase one funding. I have received a research grant from one of the early customers to help support my university laboratory for three years at $25,000 per year. This has also resulted in a collaboration which helps make my students more knowledgeable about real industrial problems and may help them find jobs when they graduate. Full scale marketing of the instrument is beginning this week with a mass mailing.

There is still much to be done with this research project, however. We have in mind several improvements to the instrument. Example applications need to be explored in several areas, particularly environmental chemistry. I am optimistic that we will receive phase two STTR funding to continue the collaboration.

I have had one previous experience with the SBIR program as a consultant to a small business which obtained a phase one grant based on an idea of mine. That project, about 12 year ago, did not reach commercialization because it required much more effort that could be supported by the SBIR grant and the business was not willing to risk substantially more of their own money. From my perspective, it was useful anyway because it helped develop new ideas and it made me and my students more aware of business research problems and opportunities.

There seems to be some similarity in structure between SBIR and STTR, but I definitely prefer the STTR program. Its emphasis on collaboration is very good because it brings people with different ideas and perspectives together. I don't think all SBIR grants should require a collaboration, but it should certainly be encouraged. STTR also seems to have a stronger emphasis on commercial potential and so is likely to produce a higher proportion of commercial successes. I think that STTR should certainly be reauthorized.

One improvement to the STTR program that I would suggest is some mechanism to get closer to a continuity of funding between phase one and phase two. It is very difficult for a really small business to stop work on a project for a few months and then restart it after phase two is granted. It is also difficult to have university students work on a funded collaboration which becomes unfunded for a period of months and is then funded again. Perhaps, the funding agencies could accept a phase one final report early if the collaborators have achieved their goals and are ready to proceed. Early completions are likely to be the most successful projects and the possibility of funding continuity would act as an incentive for rapid and efficient progress.

United States General Accounting Office

GAO

Testimony

Before the Committee on Small Business
House of Representatives

For Release on Delivery
Expected at
10:00 a.m. EST

March 6, 1996

FEDERAL RESEARCH

Interim Assessment of the Small Business Innovation Research and Technology Transfer Programs

Statement by Victor S. Rezendes
Director, Energy, Resources, and Science Issues
Resources, Community, and Economic
Development Division

Madam Chair and Members of the Committee:

We are pleased to be here today to discuss the results of our reviews of the Small Business Innovation Research (SBIR) Program[1] and the Small Business Technology Transfer (STTR) Pilot Program.[2] The Small Business Innovation Development Act of 1982, which authorized the SBIR Program, emphasized the benefits of technological innovation and the ability of small businesses to transform the results of research and development into new products. Reflecting its view of the program's success, the Congress reauthorized the program in 1992. In the same 1992 legislation, the Congress also established the STTR Program, which is closely modeled on the SBIR Program. The STTR Program differs from SBIR primarily in requiring a company to form a partnership with a non-profit research institution. We have issued two reports on these programs in which we discussed the (1) quality of research proposals in the SBIR and STTR Programs, (2) duplication of funding for SBIR projects, (3) steps being taken to avoid conflict of interest that would arise if a party both submitted and evaluated STTR proposals, and (4) effect of and need for the STTR Program. In addition, as directed by the 1992 legislation, we will provide a detailed study covering all of the major issues affecting the SBIR Program in 1997.

Our discussion today highlights the message of our two most recent reports. In summary, Madam Chair:

-- The quality of SBIR and STTR research proposals appeared favorable when we issued our reports. For the SBIR Program, our view was based on the (1) high level of competition, (2) large numbers of proposals that agencies deemed worthy of funding but that received no award, and (3) views expressed by program officials that quality was being maintained. Nevertheless, it was too early to make a conclusive judgment about the long-term quality of SBIR research proposals because the major increases in program funding had not yet occurred. For STTR, technical experts generally concluded that the proposals called for high quality research. As one example, the Department of Energy (DOE) rated the quality of proposed research in all of its winning proposals as being among the top 10 percent of research in the Department. At this time, however, the actual results of these awards cannot be assessed because of the newness of the program.

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[1] Federal Research: Interim Report on the Small Business Innovation Research Program (GAO/RCED-95-59, Mar. 8, 1995)

[2] Federal Research: Preliminary Information on the Small Business Technology Transfer Program (GAO/RCED-96-19, Jan. 24, 1996)

- -- In our SBIR report, we noted that there was duplicate funding of similar research, especially with the increasing numbers of research proposals submitted to the SBIR Program. We made several recommendations to reduce the possibility of duplicate funding in the future. The Small Business Administration (SBA) is preparing to implement our recommendations in this area.

- -- In our STTR report, we addressed congressional concerns about potential conflicts that might arise if a federally funded research and development center formed a partnership with a company submitting an STTR proposal and then helped a federal agency judge the merits of its own and other proposals. We found that the five agencies in the program have taken steps to avoid such problems.

- -- Views differed on the effect of and need for the STTR Program. The agencies provided no evidence at this early point in the program to suggest that the STTR Program was competing for quality proposals with the SBIR Program or reducing the quality of agency R&D in general. Some officials noted potentially beneficial effects such as greater collaboration between small businesses and research institutions in the SBIR Program. The similarity of the two programs, however, raises an issue about the need for the pilot program. One way to assess the need for the program is to determine its effectiveness in transferring technology from research institutions to the marketplace. Such information will not be ascertainable for several years because of the time needed to turn an initial concept into a marketable technology.

BACKGROUND

The Small Business Innovation Development Act of 1982, which authorized the SBIR Program, designated 4 major goals for the program: to stimulate technological innovation, to use small business to meet federal R&D needs, to foster and encourage participation by minority and disadvantaged persons in technological innovation, and to increase private sector commercialization of innovations derived from federal R&D. The Small Business Research and Development Enhancement Act of 1992 reauthorized the SBIR Program and established the STTR Program, closely modeled on the SBIR Program.

Eleven federal agencies participate in the SBIR Program. Five major agencies--the Department of Defense (DOD); National Aeronautics and Space Administration (NASA); Department of Health and Human Services and particularly its National Institutes of Health (NIH); DOE; and National Science Foundation (NSF)--also participate in the STTR Program.[3] Each agency manages its own program while the SBA plays a central administrative role and issues policy directives and annual reports for each program.

The legislation establishing the SBIR Program required each agency with an external R&D budget in excess of $100 million to set aside a certain percentage of this amount for the program. The percentage was increased incrementally until it reached 1.25 percent in 1986. The 1992 reauthorization legislation increased program funding to not less than 1.5 percent for fiscal years 1993 and 1994, not less than 2 percent for fiscal years 1995 and 1996, and not less than 2.5 percent for fiscal year 1997 and thereafter. This increase will effectively double the funding for the program to nearly $1 billion in fiscal year 1997.

In establishing the STTR Program, the legislation required each agency with an external R&D budget in excess of $1 billion to set aside not less than 0.05 percent of that budget in fiscal year 1994, not less than 0.1 percent in fiscal year 1995, and not less than 0.15 percent in fiscal year 1996 for the STTR Program. In the first year of the program, the agencies expended about $20 million; they estimate that funding will triple to $60 million in the third and last year of the pilot program.

SBIR and STTR funding is provided in two phases. Phase I is intended to determine the scientific and technical merit and feasibility of ideas; it generally lasts about 6 months for SBIR and 1 year for STTR. Phase II further develops the proposed ideas and generally lasts about 2 years. The 1992 reauthorization directed SBA to set the general limits on the size of SBIR phase I and II awards at $100,000 and $750,000, respectively, although awards may be for less than these amounts. It also set the general limits for STTR awards at $100,000 and $500,000, respectively. A third phase for SBIR and STTR projects, where appropriate, involves the continuation or commercial application of the R&D.

Although the two programs have many points in common, they differ in one important respect. To be eligible for an STTR award, a small business must collaborate with a nonprofit research institution such as a university, a federally funded research and development center, or other entity. This collaboration is permitted under the SBIR Program but is not mandatory. This special STTR requirement, according to a 1992 report,[4] was to provide a more effective mechanism for transferring new knowledge from research institutions to industry.

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[3] The other 6 SBIR agencies include the United States Department of Agriculture, Department of Commerce, Department of Education, Department of Transportation, Environmental Protection Agency, and Nuclear Regulatory Commission.

In addition to the two reports we have already provided, the legislation directed GAO to report on SBIR in 1997; the upcoming report will be a detailed study covering all of the major issues affecting the program.

QUALITY RESEARCH PROPOSALS CHARACTERIZED BOTH PROGRAMS

The quality of the proposed research in both programs was one of the principal issues discussed in our reports. In general, we believe the quality of the winning SBIR and STTR proposals is favorable.

For the SBIR Program, the quality of research proposals appeared to have kept pace with the program's initial expansion. However, at the time of our March 1995 report, it was too early to make a conclusive judgment about the effect of the funding increases on the quality of SBIR research proposals receiving awards because only the first (and smallest) of the three slated increases had occurred at the time of our report.

In general, the level of competition for SBIR awards remained high following the initial increase in funding in fiscal year 1993. In all five major agencies during fiscal year 1993, the number of proposals rose between 9 and 30 percent. The increased numbers of proposals were important in maintaining the competitiveness of the program during the first year that the program's funding percentage grew to 1.5 percent. In addition, the ratio of awards to proposals within each agency remained fairly constant, ranging from 8 percent (for DOE) to 28 percent (for NIH). Among all five agencies, the data for fiscal year 1993 showed virtually no change in the ratio from the previous 2 years, suggesting that the funding increase exerted no adverse effect on the competitiveness of the program.

In addition, agencies deemed many more SBIR proposals worthy of award than they were able to fund. In some agencies, the large number of worthy but unfunded projects greatly exceeded the number of projects receiving awards; for example, the Air Force deemed 1,174 proposals worthy of award in fiscal year 1993 but funded only 470. In general, the data showed substantial reserves of projects deemed worthy of funding but receiving no award. In addition, SBIR program officials in the five major agencies stated that, in their view, the quality of research proposals was being maintained or even improved. They cited the level of competitiveness and the large reserves of unfunded but worthy projects as the principal reasons for their view.

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[4] H.R. Rep. No. 554, 102d Cong., 2d Sess., pt. 1 (1992). The report accompanied H.R. 4400, a predecessor to the bill (S. 2941) that was enacted.

Technical evaluations of STTR proposals, which served as the basis for the selection of winning proposals, also showed favorable views of the quality of proposed research. Nevertheless, it was too early for us to make a conclusive judgment about the quality because of the newness of the program. We reviewed all of the evaluations for each of the 206 winning STTR proposals in fiscal year 1994, the first year in which awards were made. The evaluations (1) rated proposals among the top 10 percent of research in certain agencies, (2) awarded perfect scores to many proposals, (3) described some proposals as "cutting edge," and (4) generally found the quality of proposed research to be excellent. For example, DOE rated the quality of research in all of its winning proposals as being among the top 10 percent of all research in the agency. Of the 48 winning proposals in NIH, 14 were judged outstanding, 31 excellent, 2 very good, and only 1 good. There were none in NIH's "acceptable" (or lowest fundable) category. In general, DOD rated its 105 winning proposals highly. Of NASA's 21 winning proposals, 11 were considered above average, and 8 were judged as being among the top 10 percent of all NASA proposals for comparable R&D. NSF regarded the quality of research for its winning proposals as excellent.

As part of our review of the quality of STTR research proposals, we also examined the technical evaluations of their commercial potential. These evaluations were generally favorable but somewhat more cautious. For example, in some cases there were concerns about the cost of the product that might result or the limited size of its potential market. Such reservations were understandable in view of the newness of the program and the innovation or risk associated with many of the proposed projects.

SBA HAS TAKEN STEPS TO ADDRESS DUPLICATE FUNDING OF SBIR RESEARCH PROPOSALS

One of the issues we discussed in our SBIR report was the duplicate funding of research proposals. According to agency officials, a few SBIR companies received funding for the same proposals twice, three times, and even five times before agencies became aware of the duplication. Several factors were contributing to this problem, including (1) the evasion of certification procedures whereby companies fail to identify similar proposals to other agencies, (2) the lack of a consensus on what constitutes a duplicate proposal, and (3) the general lack of interagency access to and exchange of current information about recent awards by other agencies.

Officials from several agencies told us that the duplicate funding problem should be viewed in the context of the 20,000 or more proposals being submitted annually. They agreed, however, that the problem should be addressed. Accordingly, we made several recommendations to the Administrator of SBA, who has taken steps to implement them. One important effort has involved the development of software to provide interagency access to current information regarding recent SBIR awards. SBA officials have recently told us that they expect to make the system operational in the near future.

AGENCIES HAVE TAKEN STEPS TO AVOID POTENTIAL CONFLICTS OF INTEREST IN THE STTR PROGRAM

In our STTR report, we found that the five federal agencies with STTR Programs have taken steps to avoid potential problems relating to conflict of interest with federally funded research and development centers. Such conflicts could occur if a center formed a partnership with a company submitting an STTR proposal and then helped a federal agency judge the merits of its own and other proposals. DOD, DOE, and NIH have specific policies intended to prevent such conflicts while NASA and NSF have more general procedures to avoid them. Under DOD's policy, for example, only two R&D centers are currently approved research partners for its STTR awardees. In fact, the Air Force had to rescind some awards because the proposed research partners (certain DOD laboratories) were ineligible to participate. According to DOD's STTR Program director, future proposals will be evaluated on a case-by-case basis to ensure that conflicts of interest do not occur.

DOD and DOE, which accounted for 29 of the 32 awards involving centers during the first year of the program, have also taken steps to prevent centers from using privileged information in preparing STTR proposals. For example, DOE's policy prohibits agency staff members from requesting or receiving assistance from personnel in research institutions (that are eligible to participate in the STTR Program) in preparing technical topics for the STTR solicitation. This policy is intended to prevent research institutions from using their expertise to influence DOE's choice of STTR research topics. Otherwise, research institutions could acquire a significant advantage by designing topics to match their expertise and then preparing a proposal in the same area.

VIEWS DIFFERED ON THE EFFECT OF AND NEED FOR THE STTR PROGRAM

Agency officials expressed differing views regarding the effect of STTR on SBIR and other agency R&D. For example, SBA officials contended that STTR was too small and too new a program to have any real effect on SBIR or on the broader range of agency research at the present time. The officials pointed out that the program represented only 0.05 percent of each agency's external R&D budget during its first year and that it was only 1 year old.

In contrast to the view that STTR's effect was very limited, the Army's STTR Program manager said that STTR was influencing SBIR in a beneficial way. In his opinion, STTR is becoming known through national conferences and other means. Furthermore, small businesses are realizing that they have more credibility and chance of winning an award by collaborating with a university or other research institution. He believes that the STTR Program has also led to more collaboration in SBIR. In general, according to the program manager, STTR is a promising program that may be as successful as the SBIR Program.

The similarity of the two programs, however, raises a broader issue about the need for the STTR Program. In the 1992 House report, the Committee on Small Business provided two basic arguments in favor of the program. First, the report stated that the program addresses a core problem in U.S. economic competitiveness, the inability to translate its worldwide leadership [in science and engineering] into technology and commercial applications that benefit the economy. Second, the report stated that, although SBIR has turned out to be remarkably effective at commercializing ideas in the small business community, it is less effective at fostering commercialization of ideas that originate in universities, federal laboratories, and nonprofit research institutions.

The rationale for the program, which points to certain weaknesses in SBIR and potential strengths in STTR, suggests three questions that are relevant in evaluating the need for STTR.

First, is the technology originating primarily in the research institution as envisioned in the rationale for the program or is it originating in the small business? The technology may originate with the research institution, the small business, or a combination of the two. In the STTR Program, the assumption is that the research institution will be the primary originator of the new concept. However, data to determine the extent to which research institutions are providing the technologies are not currently available. Neither SBA nor the agencies have collected this information. The relative roles of the research institution and the small business as the source of the technology bear directly on the need for the STTR Program. If a high percentage of the ideas are originating with small businesses rather than with research institutions, this finding would raise questions about the need for the program. On the other hand, if a high percentage of ideas are originating with research institutions, this finding would suggest that the program was achieving the first step in moving ideas from research institutions to small businesses.

Second, if the program is effective in moving ideas from research institutions to small businesses, then the next logical question concerns whether their collaboration is effective in moving them to the marketplace. This question can be approached from two directions: (1) Short-term views of how well the collaboration is working in general and (2) long-term data on actual commercialization. Information on how well the collaboration is working can be obtained in the near future. Information on actual commercial outcomes will require a greater amount of time before it can be obtained. Generally, 5 to 9 years are needed to turn an initial concept into a marketable product.

Third, because one important difference between the two programs is that STTR makes a small business/research institution collaboration mandatory, the question arises whether the SBIR Program could accomplish the objective of transferring technology from research institutions to the private sector without mandatory collaboration. The rationale for the STTR Program tends to assume that such collaborations were relatively rare in the SBIR Program. However, NIH's Program manager told us that, in an SBIR survey undertaken by NIH several years ago, collaboration between small businesses and universities was already evident in well over half of NIH's SBIR projects. By contrast, the Army's program manager believed that STTR's impact will be greater in the Army than in agencies such as NIH because the Army has had a lesser degree of involvement with universities and other research institutions in the past. Given the apparent variation from one agency to another and the lack of current data, no definite conclusion can be drawn at present concerning the need for STTR in forging new collaborations.

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In summary, the quality of both the SBIR and STTR Programs appeared favorable at the time of our reports, although it was too early in each case to make a conclusive judgment about the long-term quality of research. In addition, the agencies have taken steps to address other concerns such as duplicate funding of SBIR projects and potential conflicts of interest in the STTR Program. Overall, the indicators relating to STTR in its first year provide evidence of a potentially promising program. More time will be needed, however, to determine whether the program is meeting a unique need or duplicating the accomplishments of the SBIR Program. Several key questions relating to the transfer of technology from research institutions to the marketplace are relevant in determining the need for the STTR Program.

This concludes my statement. I would be happy to respond to any questions you or the members of the Committee may have.

(307739)

TESTIMONY OF
ROBIN FRANK RISSER
CHIEF EXECUTIVE OFFICER
PICOMETRIX, INC.
BEFORE THE
COMMITTEE ON SMALL BUSINESS
OF THE
HOUSE OF REPRESENTATIVES
MARCH 6, 1996

Good morning, Chairman Meyers and members of the committee. My name is Robin Risser. I am a founder and CEO of Picometrix, Inc. and also serve on the Board of Directors of several high technology companies. In addition, I am active in small business technology policy issues at both the national and state levels. At the national level, I serve on the National Small Business United's technology and capital formation committees. I was also a Michigan delegate to the 1995 White House Conference on Small Business (WHCSB) and currently serve as WHCSB Region V technology implementation co-chair. In Michigan, I serve on Governor Engler's Venture Capital Task Force and on the Board of Directors of the Small Business Association of Michigan (SBAM) where I serve as founding chair of its technology committee.

Picometrix is a technology based small business located in Ann Arbor, Michigan. We have participated in both the Small Business Innovation Research (SBIR) Program and the Small Business Technology Transfer (STTR) program. We have been successful in obtaining seven (7) SBIR Phase I or Phase II awards. We have submitted STTR proposals but have not received an award. On behalf of Picometrix, NSBU, the White House Conference on Small Business delegates and myself, I want to thank you for this opportunity to speak about the STTR/SBIR program and its importance to entrepreneurial technology companies.

Steve Williamson and I founded Picometrix four (4) years ago to develop and manufacture technology that was originally invented at the University of Michigan (U of M) Center for Ultrafast Optical Science (CUOS). The United States is the world leader in ultrafast optical science, which has application in the communications, medical, military, scientific instrumentation and semiconductor markets. We make extremely fast opto-electronic devices that work in conjunction with lasers. Last year we introduced a product line to the market, a family of fast photodetectors used by the communications, scientific and laboratory markets. Our fastest photodetector detects a laser pulse in only seven (7) picoseconds, which makes it the fastest photodetector in the world. By way of background, a picosecond is a trillionth of a second. Light travels around the earth approximately 2 ½ times per second. In a picosecond, it travels approximately the thickness of this piece of paper. Researchers need scientific tools that operate at these speeds in order to make the next scientific breakthroughs in many fields. Next generation military, Satellite and fiber optic communications will utilize this technology in order to provide the bandwidth necessary to realize the full potential of the information superhighway. The recent passage of the Telecommunications Act of 1996 combined with technological advances should help accelerate the realization of this dream

Without the SBIR program, Picometrix's products would never have gotten to market. Technology product development usually takes a long time, has high technical risks and requires substantial financial resources. In our case the largest markets were a decade or more away. As a result, we did not meet a key need of the venture capitalists; large market opportunities within 3 to 5 years. The Phase I SBIR contract from the Ballistic Missile Defense Organization (BMDO) and the Phase I and Phase II SBIR contracts from the Air Force and Advanced Research Projects Agency (ARPA) enabled Picometrix to transfer the technology out of the U of M, rent the U of M's microfabrication facilities and hire the necessary University Ph.D. graduates to further develop this technology Success with these SBIR contracts enabled us to enter into a worldwide sales, marketing and distribution arrangement with a larger US corporate partner. We are currently pursuing several other leading US corporate partnerships as well as defense department procurement contracts. Without the research and development resources provided by the SBIR program, small and start up manufacturers like us would be unable to develop and commercialize technology. As a result the technology would go undeveloped or would not be developed until years later.

I personally believe that our model of licensing technology, hiring recent graduates to transfer the technology and cost effectively developing the technology further by renting unique equipment and facilities where appropriate from the research institution is a good model. It is a model that empowers the small business and improves commercialization success by:

1. Placing responsibility for technology development and commercialization in the same for-profit entity,

2. Allowing the small business to own and protect any future intellectual property that may be invented during the development process,

3. Providing for appropriate collaboration with research institutions and

4. Focusing all available resources on the single minded goal of technology development and commercialization.

I am certain that these goals can be accomplished with the SBIR program. I hope that the STTR program can also accomplish these goals. However ensuring that all available resources are focused solely on the goals of commercialization and efficient technology development will require very progressive technology transfer policies by the research institutions; since they can accomplish their mission of research and development without achieving these goals. Progressive technology transfer policies by research institutions which encourage the small business to efficiently allocate R & D resources and own intellectual property which may result from STTR R & D efforts are the exception rather than the rule.

The WHCSB National Conference Recommendation Agenda (NCRA) number 406, entitled "Investment Initiatives for High-Tech Firms" included:

- Expanding, improving and making permanent the SBIR/STTR programs by:
    1. excluding cost sharing in proposal evaluation and scoring for either Phase I or Phase II awards, and prohibiting agencies from imposing artificial ceilings on indirect and R & D expenses;
    2. SBA's directing agencies to budget an appropriate portion of administrative overhead, and committing adequate personnel to managing the SBIR program.

The point I want to make today regarding recommendation number 406 relates to improving an already very good SBIR/STTR program. The total cycle time from submitting a Phase I proposal to completing the Phase II research takes too long, typically 3 1/2 to 4 years. The R & D itself typically takes 2 1/2 years. Thus the administrative lag in the system is one (1) to one and one-half (1 1/2) years, or up to 38% of the total elapsed time. In today's global economy product development life cycles are rapidly reducing and first to market provides a significant competitive advantage. New product development cycles are less than one year in the computer industry and only 3 to 4 years in the automobile industry. I believe that the total SBIR cycle could be reduced to 3 years through administrative efficiencies that could be realized across agencies. These efficiencies should include reducing the time between submission of an SBIR Phase I proposal and execution of the Phase I contract. This process can often take 9 months to 1 year. In addition, the time between submission of a Phase II proposal and execution of a Phase II contract should be reduced. This process often takes 6 to 9 months. These administrative lags not only represent idle time for the technology development, but also reduce the efficiency of the technology development team. During these administrative lags, the development team usually must work on other projects. The Department of Defense's recently enacted "Fast Track" program is an effort to significantly reduce the administrative lag and thus shorten the total cycle time. The WHCSB delegates applaud the goals of this pilot program. While we disagree with some of the requirements for qualifying for the "Fast Track" we are confident that it will serve as a constructive model for improving the total cycle time of the SBIR/STTR process. The WHCSB technology chairs have also been working closely on streamlining the administrative process with Dan Hill, SBA Assistant Administrator of Technology Programs. We have found Dan to be a man of action and are extremely pleased with the cooperation, direction and leadership Dan has provided in the short time that he has occupied this position.

WHCSB recommendation number 406 is entitled " Investment Incentives for High-Tech Firms" but is know to the WHCSB delegates as "the need for long-term, patient capital". Improvements in encouraging the formation and investment of this capital in SBIR/STTR companies is of great importance and has the potential of having the greatest impact of any actions you could undertake to improve the commercialization of the SBIR/STTR results. Despite the fact that our financial markets and venture capitalists are having record years, the availability of private investment to further develop SBIR/STTR technology and markets suffers from an acute shortage of available capital. This is the high risk capital required to move a technology from the start-up and seed stage to the rapid growth stage preferred by the venture capital industry. Once a company (and thus a technology) progresses to the venture capital stage, the established financial structure and markets provide adequate capital. This early stage capital is typically provided by angel investors, investors with high net worth that often made their fortunes in their own businesses. Unfortunately, the angel capital market is very inefficient due in large part to regulatory and educational barriers. The advent of the Internet and the information superhighway offer tremendous opportunities to make this market more efficient and therefore provide significant new capital to SBIR/STTR companies for Phase III commercialization. Now that low cost and widely available electronic communication is a reality, all that is needed is to reduce transaction costs and regulatory barriers which restrict the flow of information over the electronic network. Some of the regulatory barriers exist at the Federal level and some at the state level. These can be reduced by administrative and legislative action at both the federal and state levels. High transaction costs can be reduced by educating small businesses and angels as well as limiting professional liability. Providing for an efficient angel investor market could unleash significant new capital and therefore significantly improve the program's commercialization objectives. The WHCSB delegates have been working closely with Jere Glover (SBA's Chief Counsel for Advocacy) and Terry Bibbens (SBA's Entrepreneur in Residence) on this issue. Their work on angel capital and all aspects of technology commercialization are wholeheartedly supported by the WHCSB delegates. We feel privileged to have such dedicated and knowledgeable individuals working in the SBA. The country stands to benefit significantly from their efforts.

In summary, the WHCSB delegates believe the SBIR/STTR programs are an excellent example of public/private sector partnership that both serves an agency mission and stimulates technology commercialization without having a negative budget impact. The WHCSB delegates support the STTR program reauthorization. I personally believe that very progressive technology transfer policies must be required of the research institutions that participate in the STTR program in order to make the program as successful as the SBIR program. In addition, the STTR and the SBIR program can be substantially improved by reducing the administrative lag in the system and improving the availability of angel commercialization capital. The SBIR/STTR programs are very effective programs that can only be made better with these improvements.

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Statement of the U.S. Chamber of Commerce

ON: SMALL BUSINESS INNOVATION RESEARCH PROGRAM and SMALL BUSINESS TECHNOLOGY TRANSFER PROGRAM

TO: HOUSE COMMITTEE ON SMALL BUSINESS

DATE: MARCH 6, 1996

BY: STEVEN ZYLSTRA

The Chamber's mission is to advance human progress through an economic,
political and social system based on individual freedom,
incentive, initiative, opportunity and responsibility.

The U.S. Chamber of Commerce is the world's largest federation of businesses and associations and is the principal spokesman for the American business community. It represents more than 215,000 businesses and organizations, including 3,000 local and state chambers of commerce, 1,200 trade and professional associations, 76 American Chambers of Commerce abroad, and six bilateral international business councils.

More than 96 percent of the Chamber's members are small businesses with fewer than 100 employees, 71 percent of which have fewer than 10 employees. Yet, virtually all of the nation's largest companies are also active members. We are particularly cognizant of the problems of smaller businesses, as well as issues facing the business community at large.

Besides representing a cross-section of the American business community in terms of number of employees, the Chamber represents a wide management spectrum by type of business and location. Each major classification of American business -- manufacturing, retailing, services, construction, wholesaling, and finance -- numbers more than 10,000 members. Yet no one group constitutes as much as 32 percent of the total membership. Further, the Chamber has substantial membership in all 50 states.

The Chamber's international reach is substantial as well. It believes that global interdependence provides an opportunity, not a threat. In addition to the 76 American Chambers of Commerce abroad, an increasing number of members are engaged in the export and import of both goods and services and have ongoing investment activities. The Chamber favors strengthened international competitiveness and opposes artificial U.S. and foreign barriers to international business.

Positions on national issues are developed by a cross-section of Chamber members serving on committees, subcommittees, and task forces. Currently, some 1,800 business people participate in this process.

STATEMENT
on
SMALL BUSINESS INNOVATION RESEARCH PROGRAM
and
SMALL BUSINESS TECHNOLOGY TRANSFER PROGRAM
before the
HOUSE COMMITTEE ON SMALL BUSINESS
by
STEVEN ZYLSTRA

March 6, 1995

Chairwoman Meyers and members of the committee, thank you for inviting me to present the experiences of Simula, Inc. with the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs. I am Steven Zylstra, Director of Business Development for Simula Government Products, which is a subsidiary of Simula, Inc. Our company is a member of the U.S. Chamber of Commerce Federation of more than 215,000 businesses, 3,000 local and state chambers of commerce, 1,200 trade and professional associations, and 76 American Chambers of Commerce abroad. I have served as a member of the Chamber's Small Business Council for six years.

At Simula, it is my job to look for potential growth opportunities. This means searching for new markets for products we have developed and different ways to expand our technological capabilities. It is not an exaggeration for me to say that not only the creation of my job but also my company's present financial and technological status stems directly from the accomplishments that resulted from SBIR-funded projects.

Today I want to impress upon you the impact that the SBIR Program in particular has had on the success of Simula and the growth of the technologies in which we are involved and especially what this success and this growth means in the lives of our employees and customers.

Simula and the Small Business Innovation Research (SBIR) Program

Simula was founded 20 years ago by a man with an idea for saving lives by improving the crashworthiness of military aircraft seating. Saving lives remains the guiding force behind Simula's research and development efforts despite our expansion into many other technologies.

That expansion took a tremendous leap between 1984 and 1994 when Simula received 24 phase I SBIR awards and 9 phase II awards, totaling over $4M. Those awards enabled a small company with a relatively narrow focus to do what it otherwise probably could not in the same period of time and to the same degree--create jobs, buy equipment, add facilities, acquire businesses, form alliances, broaden marketing efforts, expand expertise. In short, the SBIR Program enabled us to grow faster and contribute more.

In those 10 years, Simula went from a company employing 45 people to one with over 500. Sales increased from nearly $4M to over $41M. Our customer base expanded world-wide and included commercial as well as military customers. Research and development broadened to include more technologies and applications.

Today, Simula is no longer a small company by SBA definition. We are a publicly held Arizona-based corporation with subsidiaries in California, North Carolina, Illinois, and Wisconsin. We have an ever-increasing employee roster and projected sales revenue for 1996 of $80M. We have transformed from a company that depended nearly 100 percent on defense-related business to one that now receives 50 percent of its revenue from non-defense sources. Further, we expect that number to drop to 25 percent within two years. Core technologies now encompass crash safety, fiber optics, armor, composites, polymers, and personal protective gear. Developments include crashworthy seating for land vehicles and aircraft, air bags, and other inflatable restraints, crash safety dummies, structural health monitoring devices, land vehicle and aircraft armor, emergency flotation devices, parachutes, and aircraft emergency escape slides. Our R&D efforts have resulted in 14 patents for innovative products and processes.

We believe that Simula's success is proof that the SBIR Program meets its objectives and in doing so makes an important contribution to the individual by creating jobs, the country by sparking economic activity, and humankind by expanding our knowledge. As examples of what I mean by this statement, I would like to briefly present the history of two of Simula's SBIR-funded projects.

Two Cases in Point

Environmentally Sealed Emergency Parachute Project

In 1986, Simula had no experience in designing parachutes nor any plan for doing so.

The company, however, did have a technician with a strong interest in skydiving and an idea for improving the equipment. He used his interest and idea to persuade management to respond to a Navy solicitation for an improved emergency parachute. This kind of event is unique to small business where, unlike many large corporations, communication is not usually bridled by bureaucracy and policy where a single technician can have a conversation with the president and actually alter a company's future.

Phase I of Simula's Environmentally Sealed Parachute Project was funded in June of 1987. We completed it in 9 months, and received a phase II award in August of 1990. Phase II work was completed in September of 1992.

The result of the project is an innovative parachute that is much lighter than ones currently in use; is protected from environmental elements, such as dirt, smog, fuel fumes, and moisture by vacuum packing; is comfortable for both male and female crew members; doesn't have to be repacked for 5.5 years; and has an improved canopy that opens quickly and provides a low descent rate. (See figure 1.)

The result is a product that fully meets the user's requirements and was developed at a relatively low cost to the customer, another occurrence that doesn't always happen in the ordinary course of business. It happened because the Navy's SBIR monitor for this project championed the cause for a parachute that would truly save more lives, and because Simula listened and delivered.

This project has recently moved into phase II with a Navy contract for $368,000, or $966,328 if all the options are exercised, to complete the qualification process and prepare for production.

The current and potential benefits derived from this project are numerous and will be shared by the country, Simula, and the individual alike. The technology will:

- save lives and lessen injuries;
- reduce maintenance and replacement costs for the customer;
- create jobs, especially as the parachute moves into production;
- be applicable to cargo and ordnance delivery;
- serve civil as well as military aviation;

- open new markets for Simula both here and in other countries; and
- expand Simula's capabilities.

Cockpit Air Bag System (CABS)

Unlike the circumstances surrounding our response to the parachute solicitation, in 1989, Simula responded to an Army solicitation for a helicopter cockpit air bag protection system with the serious confidence that comes from many years of research and development in a particular arena.

Simula received phase I funding for what was to become the development of the cockpit air bag system (CABS) in August of 1989, and received phase II funding in December of 1991.

Early in the project, participants believed that automotive air bag technology could be more applicable than testing proved it to be. As the nature of the problem became clearer, we pursued a more workable solution.

Using the expertise and knowledge we gained in our development of crashworthy helicopter seating and the Inflatable Body and Head Restraint System (IBAHRS), we proposed an air bag crash protection system that specifically addressed the realities of the attack helicopter cockpit environment and crash characteristics. (See figure 2.)

The result of the project is a system that includes lateral and frontal air bags providing wrap-around protection that protects the crewmember from striking interior parts of the aircraft and reduces involuntary head motion, general flailing, and rebound. It also continues to provide protection during subsequent impacts. Testing further showed that the system is safe and doesn't create a hazard in the event of inadvertent deployment.

The CABS project moved into phase III mode in May of 1994 with a joint program with the Army, Navy, FAA, Air Force, Marine Corp., and Coast Guard for $4.3M and in July of 1995 with an Army contract valued at $4.4M. The purpose of the joint contract is to continue the development of aircraft air bag technology using the UH-60 family of helicopter (Blackhawk and its derivatives) as the demonstration platform. The Army contract asks for a cockpit air bag system that is specifically designed and produced for the AH-64 Apache helicopter.

Like Simula's sealed parachute project, the current and potential benefits derived from this project are also numerous and shared. This technology too will:

- save lives and lessen injuries;
- create jobs; and
- serve commercial and civil aviation, as well as military aviation.

The knowledge and capabilities we gained as we pursued the CABS project has and will continue to make a dramatic impact on Simula's future. What we learned led us to enter and become a leader in the automotive crash protection field with our development of a side-impact protection system. In order to effectively commercialize this system, Simula recently created ASD-Simula, a subsidiary devoted to handling the commercialization of this and future automotive safety innovations. The side-impact protection system, known as the Inflatable Tubular Structure (ITS), will be installed in 1997 BMWs. (See figure 3.)

The discoveries and accomplishments we made with the CABS project has also opened new possibilities for us in the commercial aircraft market. Currently, we are developing a bulkhead air bag system (BABS) for that market. (See figure 4.) Simula is undertaking this project in response to new FAA regulations regarding protecting passengers from striking aircraft bulkheads in survivable crashes.

Small Business Technology Transfer (STTR) Program

Unlike the SBIR Program, the Small Business Technology Transfer (STTR) Program is not one with which I can speak from experience. To date, Simula has not participated in any STTR projects. Oddly enough, this doesn't keep me from having an opinion and sharing that with you today. As I understand it, the STTR Program provides a mechanism that allows mutually beneficial partnerships between not-for-profit small businesses to share discoveries, innovation, and knowledge. These partnerships between well-funded institutions and not-so-well-heeled small businesses rarely occur naturally. Yet, they can do a lot to advance us technologically; promote us economically; and, depending on the particular project, benefit us individually in any number of ways.

On behalf of Simula, I recommend that the STTR Program be continued through the current sunset date for the SBIR Program, which, I believe, is the year 2000.

Problems and Recommendations

The implementation of the SBIR Program has two major problems. First, there is a time lapse between phase I and phase II funding that, in our experience, is typically more than a year. This can be extremely problematic for the small business that does not have the resources to continue project work during that gap. Unfortunately, these are the very businesses that most need the help of the SBIR Program offers. The lapse in funding often means that work is stopped, progress is lost, jobs are eliminated, and sometimes company doors are closed.

Secondly, the program does not provide companies with a formal means of assisting them in bringing their innovations to the marketplace--even though one of its primary objectives is to increase the commercial applications of funded research and development results. This weakness seriously undermines the program's tremendous potential for fueling technological and economic growth. It promotes a kind of pointlessness--research for the sake of research.

Solutions to these problems have been undertaken by one of the program agencies--the Department of Energy (DOE). To eliminate the funding gap, DOE employs a contracting procedure that allows companies to solicit phase II funding prior to completing phase I work. If its phase II proposal is accepted, the company is initially funded for 120 days. At the end of this period, the agency reviews the results produced to date and either continues phase II funding with no break or rejects the company's phase II proposal. This approach is not without risks to the company. But for those who could not survive the funding gap, it offers a possibility for continuance that wouldn't otherwise exist.

DOE also provides a highly effective commercialization assistance program. The agency hires a management consulting company to teach company representatives, often scientists and engineers, how to bring the results of their company's work to the marketplace. The consultants take the small businesses step by step down the commercialization path. They are shown, for example, how to perform market research, produce a business plan, and elicit investors. In fact, the assistance program actually requires the participants to accomplish these very tasks and provides individual guidance.

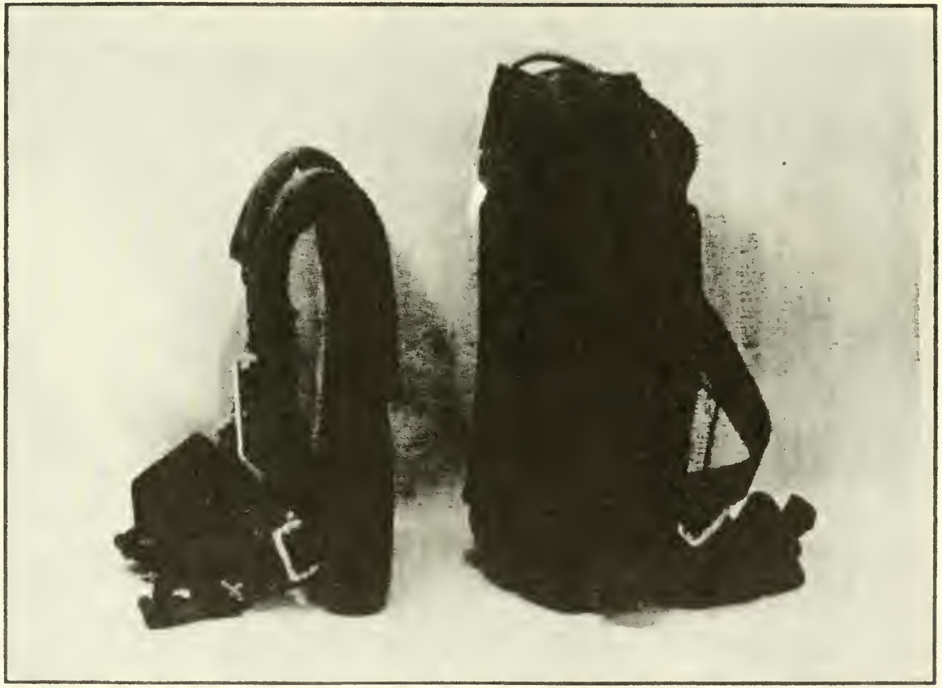
I recommend that all the agencies responsible for implementing the SBIR Program adopt these measures or ones even more effective. I ask that they bear in mind that for many small businesses, the problems mentioned are occurring now.

Conclusion

The SBIR Program is an excellent example of our government serving our people. Simula's success is evidence that, while not perfect, this program does meet its objectives, and these objectives are distinctly worthwhile.

Thank you again for the opportunity to testify before you on behalf of the U.S. Chamber of Commerce. I would be happy to respond to any questions you may have.

Emergency Bailout Parachute



Simula NB-8 (U.S. Navy)

Figure 1.

Cockpit Air Bag System - CABS

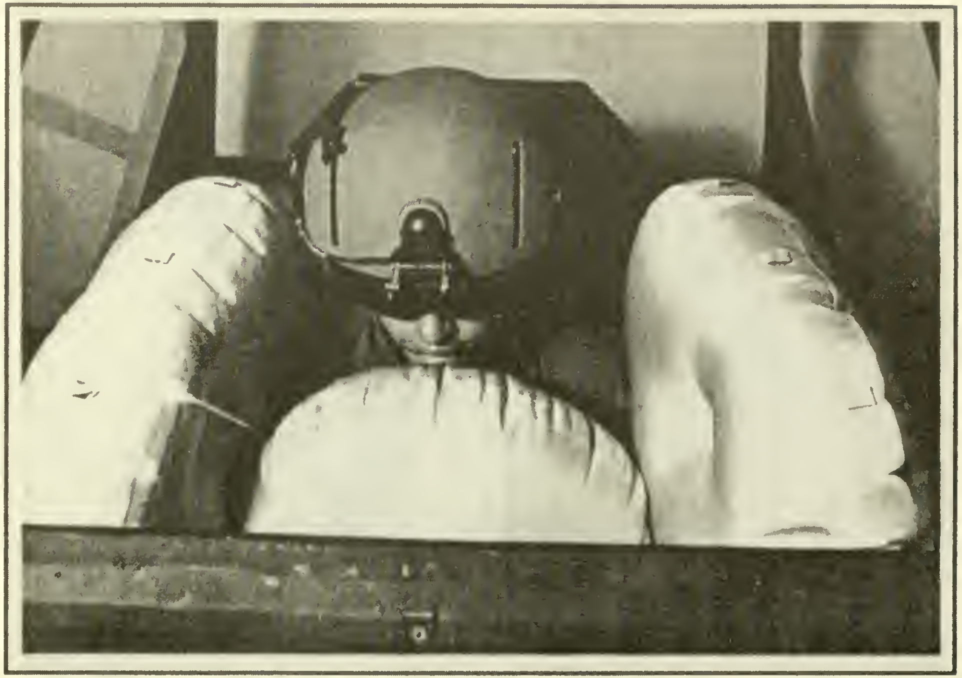


Figure 2.

Inflatable Tubular Structure - ITS

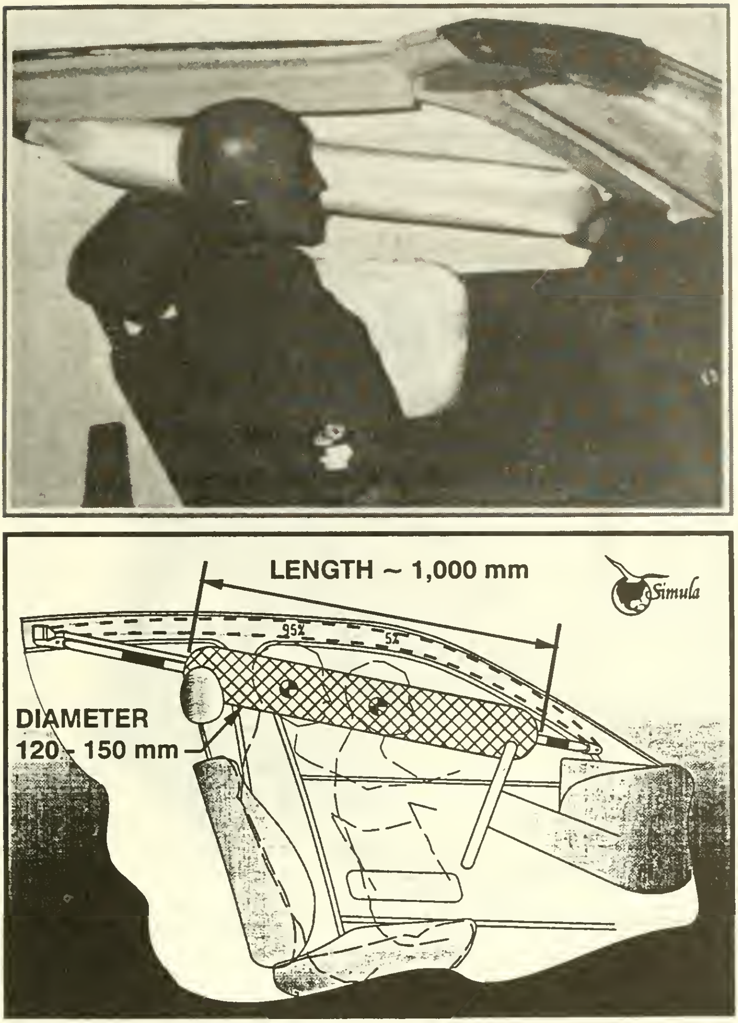


Figure 3.

Bulkhead Air Bag System - BABS

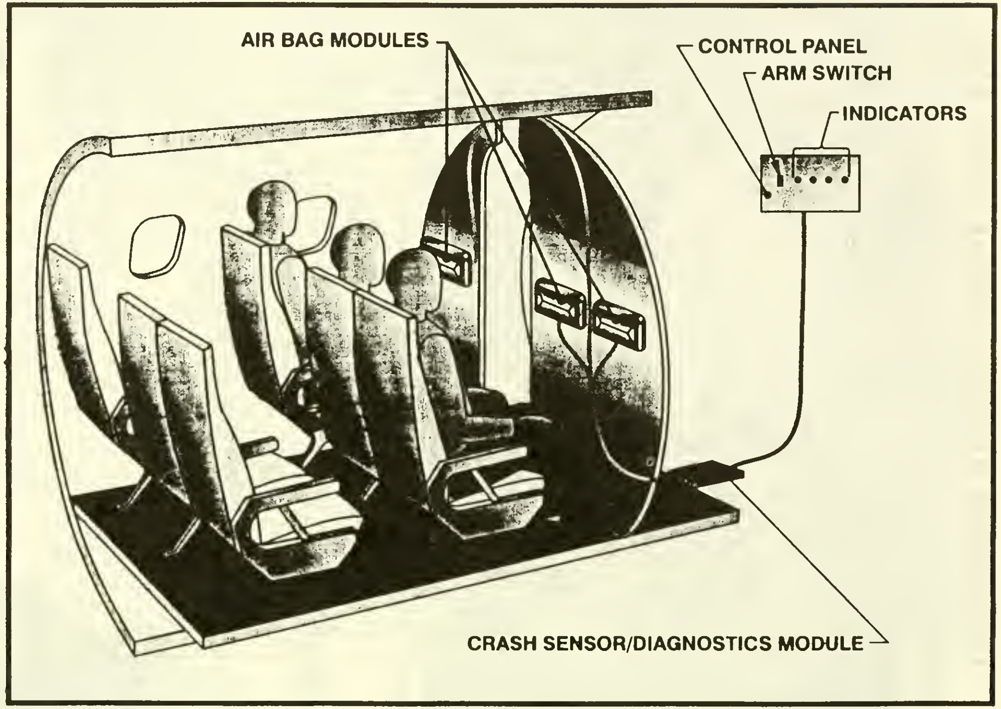


Figure 4.

U.S. SMALL BUSINESS ADMINISTRATION
WASHINGTON, D.C. 20416

OFFICE OF CHIEF COUNSEL FOR ADVOCACY

TESTIMONY OF

JERE W. GLOVER

CHIEF COUNSEL FOR ADVOCACY

UNITED STATES SMALL BUSINESS ADMINISTRATION

SUBMITTED TO THE

COMMITTEE ON SMALL BUSINESS

OF THE

HOUSE OF REPRESENTATIVES

MARCH 6, 1996

Madame Chair and members of the Committee: It is a particular pleasure for me to submit testimony to the Committee on Small Business on the subject of the Small Business Innovation Research program (SBIR).[1] Small business innovation is a topic that has been of high interest to me from my earliest days in Washington. In 1978 I staffed Joint House and Senate Hearings on Small Business Innovation that focused on the exclusion of small business innovators from many federal research programs. At that time, the Committee saw many structural impediments to the use of small technology companies by our federal research community.

From those early investigations, a bipartisan effort was initiated to ensure that the creative talents and entrepreneurial spirit of America's small businesses were better utilized in our national research agenda. The SBIR program was established by the Small Business Innovation Development Act of 1982 (Public Law 97-219) with broad bi-partisan support in Congress and was signed into law by President Reagan. The delegates to all three White House Conferences on Small Business (1980, 1986 and 1995) have voted for recommendations that strongly support the SBIR program. Clearly, we have strong bipartisan and solid grass-roots support for this program.

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[1] My testimony reflects the independent views of the Chief Counsel for Advocacy and may or may not reflect the views of the Administration.

Today I will focus my testimony on three major SBIR elements:

1) Success of the SBIR program
2) Commercialization
3) Capital needs generated by the SBIR program success.

SUCCESS OF THE SBIR PROGRAM

As presented in the testimony from Daniel Hill, Assistant Administrator of the Office of Technology at the U.S. Small Business Administration, the SBIR program is viewed as a highly successful program by the Administration, the funding agencies, the General Accounting Office,[2] and by the many companies that participate in it. It is one of the best examples of a well constructed federal program because it provides:

1. **High quality research to the funding agencies.** The responses from SBIR program managers to the GAO questionnaires indicated that 50 percent of the SBIR projects were rated as having "About the same" quality of research as other agency research, with 29 percent rated as "Much better" or "Somewhat better."[3] As reported by GAO in 1995, "the quality of research

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[2] The list of seven GAO reports and studies is attached to this testimony.

[3] GAO Report Number RCED-89-39, Assessment of Small Business Innovation Research Programs, January 1989, page 38.

proposals has kept pace with the program's expansion."[4]

2. **Solid contribution to the R&D goals of the funding agencies.** Sixty-four percent of the responses to GAO queries indicated that the SBIR had "Very Great", "Great" or "Moderate" contribution to the agency R&D goals.[5]

3. **Low proposal costs for the participating companies and low review costs for the funding agencies due to the 25-page limitation on proposals.**

4. **A highly competitive program with more good proposals than can be funded--typically by a ten-to-one ratio.** The initial concerns about the ability of small businesses to provide a sufficient number of quality proposals to continue the high caliber of research, and the concerns that the quality could be maintained as the SBIR program grew have been demonstrated to be unfounded. As reported by GAO, "...the large numbers of

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[4] GAO Report Number RCED-95-59, Interim Report on the Small Business Innovation Research Program, March 1995, page 17.

[5] GAO Report Number RCED-89-39, Assessment of Small Business Innovation Research Programs, January 1989, page 27.

worthy but unfunded projects suggest the quality research proposals kept pace with the program's initial expansion."[6]

5. **High commercialization rates.** As reported by GAO in 1992 (on 1991 results):

> "Even though many SBIR projects have not yet had sufficient time to achieve their full commercial potential, the program is showing success in Phase III [commercial] activity. As of July 1991, the program had generated about $1.1 billion in Phase III sales and additional funding for technical development--two key indicators of the program's commercial trends. In addition, up to $3 billion more is expected by the end of 1993. The majority of this activity occurred in the private sector, showing a trend toward one of the program's goals--increasing private-sector commercialization."[7]

A 1991 SBA commercialization report concluded that "more than one in every four awardees (27 percent) either would have achieved commercialization or were likely to achieve commercialization six years after receiving their Phase II funding."[8] As reported in the testimony of the U.S. Small Business Administration to this Committee today, "The [commercialization] percentage is close to 40 percent when we consider products that are the result of more than one contributory SBIR project."[9]

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[6] GAO Report Number RCED-95-59, Interim Report on the Small Business Innovation Research Program, March 1995, page 15.

[7] GAO Report Number RCED-92-37, Small Business Innovation Research Shows Success but Can Be Strengthened, March 1992, page 4.

6. **An opportunity for small companies to bring new products to market that would not otherwise receive the funding support necessary for their development.** As reported by the SBA, "More than 60 percent of the respondents attributed nearly all of their project's success to SBIR. And 84 percent said their technology development would not have been pursued without SBIR assistance."[10] The GAO analysis reported, "Only 16 percent said they would have definitely or probably done the research without the SBIR program, 20 percent

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[8] U.S. Small Business Administration, Office of Technology, Results of Three-Year Commercialization Study of the SBIR Program, 1991, page 5.

[9] Testimony of Daniel O. Hill, Assistant Administrator for Technology, U.S. Small Business Administration, before the Committee on Small Business, House of Representatives, March 6, 1996.

[10] U.S. Small Business Administration, Office of Technology, Results of Three-Year Commercialization Study of the SBIR Program, 1991, page 2.

> were uncertain, and 64 percent said they definitely or probably would not have proceeded."[11]

The preliminary reports on the Small Business Technology Transfer (STTR) program indicate that it is also achieving the goals established by Congress. As reported by GAO, "Agencies generally rated the quality of the proposed research and commercial potential in STTR proposals highly. For example, DOE rated the quality of research in all 21 of its winning proposals as being among the top 10 percent of all research in the agency."[12]

COMMERCIALIZATION

The commercialization successes of the SBIR program reported by GAO and SBA deserve special attention. At first, the report of a 27-percent, or even a 40-percent, commercialization rate may seem to be a low number--a legitimate question is, "What happened to the other 60-percent or 73-percent?" In addressing this question, I will cover three elements:

1. The research and development process;
2. Timelines of technology transfer from the laboratory to the marketplace; and
3. Comparison between the commercialization rates of the

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[11] GAO Report Number RCED-89-39, Assessment of Small Business Innovation Research Programs, January 1989, page 22.

[12] GAO Report Number RCED-96-19, Preliminary Information on the Small Business Technology Transfer Program, January 1996, page 14.

SBIR program and projects involving industry and federal laboratory partnerships, and industry by itself.

1. **The Research and Development Process.** The SBIR program is fundamentally driven by the research goals of the funding agencies, and its basic purpose is to further the research efforts of the United States. Research by its nature requires scientists to try a variety of approaches to find the solutions that work best. In university and federal laboratory research, and in the SBIR program, it is expected that some of the research effort will go into discovering what doesn't work. The fact that the SBIR programs are rated as high-quality research by the funding agencies means that by the very nature of the program, some projects will not result in commercial success. They will expand our knowledge, but not provide products. In fact, the general rule of thumb for the funding agencies is that through a rigorous technical peer review of all programs, they select only about half of the initial Phase I programs for Phase II funding.

The 40-percent commercialization rate described above by Mr. Hill for multiple SBIR awards supports the value of the incremental process of the SBIR program. Rather than funding a company on a long-term effort, regardless of progress, the rigorous process of requiring companies to submit new competitive proposals, utilizing the experience gained from past programs, ensures a balanced focus on quality research and commercialization.

2. **Timelines of Technology Transfer.** The second element of the answer of commercialization is the time required to move products from the laboratory to the marketplace. The process of commercializing a new technology is one that takes a number of years and GAO properly notes that even the relatively mature SBIR program is still in the adolescent years from the standpoint of product maturation. For example, in the health sciences, clinical trials may involve three to ten years before a product is declared safe and efficacious. In the defense community, technical evaluations and operational evaluations may involve four to seven years before production authorization is provided. Even in the commercial or consumer marketplace, three to ten years for product acceptance is a common time line for new technologies. The data from the SBA commercialization study indicates a typical product maturation schedule of seven to ten years.[13]

3. **Comparison of SBIR commercialization rates with other technology centers.** The data from most commercialization studies of other technology centers are generally gathered in a somewhat different manner than that collected by SBA and GAO for the SBIR

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[13] U.S. Small Business Administration, Office of Technology, Results of Three-Year Commercialization Study of the SBIR Program, 1991, page 11.

program, so caution must be exercised in developing direct comparisons. In particular, because of the higher rate of innovation by small firms,[14] care must be taken in comparing commercialization rates. However, with caveats, some perspective can be provided.

A study by Professor Barry Bozeman, et al., from the Georgia Institute of Technology, provides a comparison of the commercial interactions of industry with federal laboratories. The data from this study "include 229 federal laboratory-industry interactions for 219 firms [median company size is 450 full-time personnel]. The projects are from 27 federal government laboratories, including most of the leaders in federal laboratory-industry commercial activity."[15] The only projects studied were those where industry specifically sought assistance from the federal laboratories because the laboratories had technologies in hand that could be of commercial value to the company. Therefore, it would be reasonable to expect higher commercialization rates than from the research-driven goals of the SBIR program. The results of the Bozeman study indicated that:

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[14] U.S. Small Business Adminstration, Office of Advocacy, The State of Small Business: A Report of the President, 1994, Chapter 3, page 109.

[15] Bozeman, Barry; Maria Papadakis; and Karen Coker, Industry Perspectives on Commercial Interactions with Federal Laboratories, School of Public Policy and Technology Policy and Assessment Center, Georgia Institute of Technology, Atlanta, GA, report to the National Science Foundation, Contract Number 9220125, January 1995, pages iv and v.

> "22 percent have already led to a new product, process or service being marketed--a high rate given the fact that most of the projects began after 1990. This rate compares favorably to [commercialization] rates from R&D performed exclusively by firms."

The fact that these commercialization rates are similar to those of the SBIR program, and that the federal laboratory technology had already been developed before being approached by the company, speaks well for the SBIR program. Bozeman notes that the 22-percent rate "compares favorably" with the experience of company-funded product research, further supporting the SBIR program. (Note that the SBIR commercialization rate, beginning with the requirement to first meet the research needs of the funding agency, is on the order of 27 percent to 40 percent.)

CAPITAL NEEDS GENERATED BY THE SBIR PROGRAM SUCCESS

I would like to add a perspective on the implications of the success of the SBIR and STTR programs for our national research, innovation and global competitiveness agendas. From the above citations it is clear that:

1. Small business owners submit proposals to the SBIR program even when they know that they only have one chance in ten of receiving an award.
2. Many worthy proposals remain unfunded.

3. Companies are not able to pursue many of their interesting programs if they do not receive SBIR funding.
4. Phase III commercialization efforts usually require outside financing to support the transition from the laboratory to the marketplace. (In fact, the use of third-party financing in the company's Phase II proposal is ranked highly in the commercialization evaluations by funding agencies.)

The inescapable conclusion of these statements is that the SBIR program is filling a vital need in the research and innovation process in the United States. If companies could find other sources of easily available investment capital for the development of new products, they would not continue to aggressively submit Phase I proposals knowing they are facing a ten-to-one rejection rate.

As shown in the most recent SBA annual report on the SBIR program, in fiscal year 1993, the funding agencies received 23,640 Phase I proposals and awarded 2,898 Phase I projects.[16] They also received 2,532 Phase II proposals and funded 1,141 Phase II projects. Thus, the total number of proposals in 1993 was 26,172 and the total number of awards was 4,039. The SBIR funding percentage increased from 1.5 percent in 1993 and 1994 to 2.0 percent in 1995 and 1996, and increases further to 2.5 percent for 1997 to 2000. Therefore, the number of proposals is now on the order of 30,000 per year, and the number of awards is on the order of 5,000.

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[16] U.S. Small Business Administration, Office of Technology, Small Business Innovation Development Act, 11th Annual Report, April 25, 1995, page 8.

The Office of Advocacy investigated the sources of capital for supporting the commercialization efforts of these small companies. Clearly, short-term bank loans are not a good source of the high-risk capital needed to support the long product and market development programs needed to bring these products to market. Companies are usually cash-starved during this phase of their growth, and interest payments on short-term loans are counterproductive. Equity, or long-term convertible debt, is required for these high-risk, lengthy, commercialization programs. The typical investment requirement is on the order of $250,000 to $1,500,000.

The traditional strategy for years has been to recommend that SBIR and STTR companies seek investments from the venture capital community. However, when we investigated this avenue of support, we found a severe shortage of venture capital for these types of companies. There is a considerable amount of capital from institutional venture firms--over $40 billion. But, it is just not going to small start-up SBIR-type companies. According to the National Venture Capital Association's latest report, the venture companies are investing about $4 billion to $5 billion per year in approximately 1,000 growth companies--at an average investment on the order of $4 million. Unfortunatley, typically less than 10 percent of these investments are in seed and start-up companies, and of those, only about half are in the technology fields.[17] This means only about 50 technology seed and start-up companies are funded by institutional venture companies per year. That doesn't begin to address the SBIR companies' needs, let alone other small technology companies.

It is clear that the SBIR program is filling not only the research goals of the funding agencies, but also the need for high-risk seed and start-up capital for small companies. The approximately $1 billion of SBIR/STTR funding each year is more than ten times the funding provided by the institutional venture capital organizations to these small technology companies. It is also clear from the SBIR/STTR program information that many good programs do not receive funding. Provding additional funding mechanisms from the private sector is required if a significant number of these programs are to reach maturity.

What our investigations uncovered is that the primary source of equity investments for the SBIR-type company are the "angels," the wealthy, business-sophisticated individuals who invest in and mentor small companies. From a study that we awarded to the Center for Venture Research, University of New Hampshire, we discovered that "Conservative estimates suggest that annually about 250,000 business angels invest $10 billion to $20 billion in over 30,000 ventures."[18] These angels are attracted to SBIR/STTR companies because the strong peer review in the highly competitive Phase I proposal process provides confirmation that the technology is sound. The SBIR/STTR funding also reduces the risk of their investment. And, the institutional venture investors are later attracted to the successful angel-funded companies, because they have usually had professional mentoring by the angel. In fact, we found that many seasoned angels attracted a following of large venture capitalists.

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[17] National Venture Capital Association, Fifth Annual Report, 1995.

We also determined that this angel market is currently not operating efficiently, primarily because of barriers to the free flow of information and high transaction costs. The Office of Advocacy has conducted a series of focus groups across the country to ensure that we are developing information that can help us improve the efficiency and effectiveness of this market. In particular, we investigated the factors that are contributing to the successes of California's Silicon Valley, and the

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[18] Wetzel, William and Jeffrey Sohl, Center for Venture Research, University of New Hampshire, Creating New Capital Markets For Emerging Ventures, September 1995, presented at the SEC Government Business Forum on Small-Business Capital Formation, Providence, RI.

Massachusetts Route 128 region. The goal of the project is to encourage similar development of technology centers in the remainder of the nation.

Our primary recommendation is to establish strong networking via a password-controlled electronic link between university-based, nonprofit organizations that are currently connecting angels and entrepreneurs on a local basis. We also are developing model terms of sale to minimize the cost of transactions and standardized disclosure requirements using the U-7 form developed for the Small Corporate Offerings Registration (which has been adopted by 42 states). Finally, we are recommending that states develop reciprocal agreements on the filings of securities for sale to this angel market.

With these improvements, we believe that the angel marketplace can accommodate a significant increase in new angels and entrepreneurs. Expansion of this "farm league" of angels and entrepreneurs will result in more, and better, investment opportunities for the institutional venture companies, pensions, and the public market via initial public offerings. These improvements are vital if the commercialization rates of the SBIR/STTR programs are to continue improving. Of course, they apply equally well to the needs of private entrepreneurs working without SBIR or STTR awards.

We are pleased to report the improved integration of the SBIR program within the SBA. Mr. Hill, with the strong support of the SBA Adminstrator, Philip Lader, has dramatically improved the visibility and cooperation between the SBIR program and the traditional SBA loan programs, licensed Small Business Investment Corporations (SBIC), and mentoring activities of the Small Business Development Centers (SBDC) and Service Core of Retired Executives (SCORE).

We would be pleased to provide any additional information on the SBIR program or any other items covered in our testimony.

LIST OF GAO REPORTS ON THE SBIR AND STTR PROGRAMS

RCED-86-13, Implementing The Small Business Innovation Development Act--The First 2 Years, October 25, 1985

RCED-86-113FS, A Profile of Selected Firms Awarded Small Business Innovation Research Funds, March 1986

RCED-87-63, Effectiveness of Small Business Innovation Research Program Procedures, June 1987

RCED-89-39, Assessment of Small Business Innovation Research Programs, January 1989

RCED-89-173, Proposed Amendments to SBIR Program, June 30, 1989

RCED-92-37, Small Business Innovation Research Shows Success but Can Be Strengthened, March 1992

RCED-95-59, Interim Report on the Small Business Innovation Research Program, March 1995

RCED-96-19, Preliminary Information on the Small Business Technology Transfer Program, January 1996

Statement of

The Principal Deputy Under Secretary of Defense for Acquisition and Technology

Honorable R. Noel Longuemare

Before the

House Committee on Small Business

on the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Programs

March 6, 1996

Embargoed Until Released by the
House Committee on Small Business

STATEMENT OF HONORABLE R. NOEL LONGUEMARE

Principal Deputy Under Secretary of Defense (Acquisition & Technology)
March 6, 1996

Madam Chair, I am pleased to have this opportunity to submit testimony on the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs. As you know, the Department of Defense (DoD) administers the largest of the SBIR and STTR programs in the federal government, accounting for about half of the total program funding. DoD therefore has a real stake in the success of these two programs.

When this Committee created the SBIR program in 1982 and the STTR program a decade later, the Committee made a major contribution not only to the small business community in this country, but more generally to the strength of the U.S. economy and of our armed forces. At DoD, we have clear evidence that the technologies funded through our SBIR program have resulted in significant improvements in U.S. military capabilities and major savings to the taxpayer. We also find evidence that the DoD STTR program, while much newer, serves as an important complement to our SBIR program by harnessing a new and different source of technologies -- technologies that originate in our nation's research institutions (i.e., universities, federally-funded R&D centers, and nonprofit research institutions).

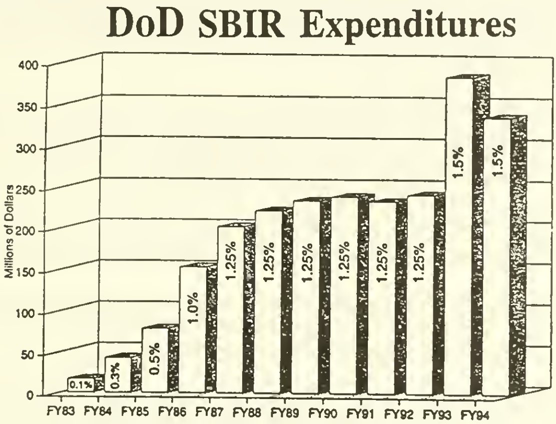
In this testimony, I will discuss some of this evidence on the effectiveness of DoD's SBIR and STTR programs. I will also summarize our recent efforts to streamline these important programs so that they better serve the needs of both the small technology companies that participate and DoD.

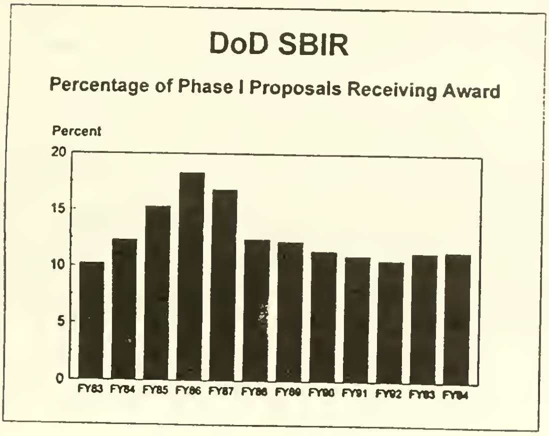
The DoD SBIR Program: Harnessing Small Business Innovation for Military and Economic Benefit

As you know, during the 1992 Congressional reauthorization of the SBIR program, the program enjoyed strong bipartisan backing not only in this Committee, but also in both Armed Services Committees and in several other Committees of Congress. That bipartisan support was based on convincing evidence that this program really worked, including a Senate Republican Leadership report on defense change, a National Academy of Sciences recommendation, and two highly favorable reviews of the program by the General Accounting Office (GAO).

We reported, shortly before the 1992 reauthorization, that "DoD wholeheartedly supports the Congressional goals of the SBIR program and is pleased to report its positive effect on all R&D programs." Our conclusion was based on a comprehensive survey, conducted by GAO, of all the scientists and engineers in DoD laboratories who monitor both SBIR research projects and other DoD (non-SBIR) research projects. These DoD scientists and engineers reported that the overall quality of the SBIR research they monitor is comparable to, and in some cases exceeds, the quality of the other agency research that they monitor. A subsequent GAO study of 686 DoD SBIR projects funded over 1984-1987 found that the projects resulted in a number of affordable, high-performance new products of significant benefit both to DoD and the private sector (sales and additional funding of $410 million as of 1991).

Today, I am pleased to report the continued success of our SBIR program. As shown in the charts below, while SBIR funding has increased significantly since the program's inception in 1983, that increase has been matched by an increase in the number of proposals. As a result, the percentage of proposals receiving an award has remained roughly constant at about 12 percent in recent years. Furthermore, a GAO report last year found that the quality of SBIR research proposals at both DoD and across the federal government has "kept pace with the program's initial expansion [since the 1992 Act]."





DoD now has several clear examples of SBIR-developed technologies that have resulted in significant improvements in U.S. military capabilities and major savings to the taxpayer. I have included a number of these examples in an attachment to my testimony, but I would like to discuss one in particular that has recently had a major effect on our Department's operations.

That example is the development of the "SaviTag," under the Navy SBIR program, by a start-up company called Savi Technology, Inc. of Mountain View, California. The SaviTag can be attached to military cargo containers -- or any other crate or container used for transport -- and will automatically track the container's location and contents. The SaviTag was developed with just $2.5 million in SBIR funding and has become a central element in DoD's "Total Asset Visibility" effort -- the DoD effort to be able to pinpoint the location and content of every plane, ship, tank, and cargo container in transit around the world. In 1994, DoD awarded a $71 million contract to Savi, and we now use the SaviTag in a large segment of our logistical operations, including almost all shipments into Bosnia.

The SaviTag solves a very real problem for DoD. During Desert Storm, over half of the 40,000 cargo containers shipped to the desert, including $2.7 billion worth of spare parts, went unused, according to a GAO report. The Army has estimated that if an effective way of tracking the location and content of the cargo containers -- such as the SaviTag -- had existed at that time, DoD would have saved roughly $2 billion. That is an enormous savings -- far more than our entire annual SBIR budget. The SaviTag has already resulted in major efficiencies in our logistical operations in Bosnia, although we don't yet have precise estimates of the savings.

As you can imagine, the SaviTag also has major applications in the private sector -- particularly in the commercial trucking, rail, and shipping industries. Savi's sales to the private sector are projected to be $5-6 million this year, and are increasing rapidly.

The attachment discusses several other examples of DoD SBIR projects that have resulted in affordable, high-performance products sold both to the military and to the private sector. On the basis of examples such as these, as well as the more systematic reviews of the SBIR program by the National Academy of Sciences and the GAO, we can comfortably conclude that our SBIR program is fostering small business innovation with significant impact on our nation's economic and military capabilities.

STTR: Joining Small Companies and Research Institutions in Cooperative R&D

Whereas SBIR funds R&D projects at small companies, STTR funds cooperative R&D projects between a small company and a research institution (i.e., university, federally-funded R&D center, or nonprofit research institution). The STTR program, according to preliminary evidence, serves a different function than the SBIR program, and one which is complementary: STTR is the vehicle enabling a researcher at a research institution to spin off a commercially-promising idea by joining forces with a small technology company. Thus, whereas SBIR harnesses the ideas in our small business sector, STTR taps into a vast new reservoir of ideas in our nation's research institutions.

There is no question that our nation's research institutions represent a technological resource of enormous proportions. These institutions employ one in four R&D scientists and engineers in the United States, and perform more than $40 billion in R&D each year. They have brought this nation to undisputed world leadership in basic research and many areas of applied research. They have generated the research breakthroughs that made the United States a military superpower in the post-World War II era.

The quarter of a million scientists and engineers in these institutions often recognize important commercial applications of their research. But there exist few efficient mechanisms enabling these scientists and engineers to pursue these commercial applications. Regular research grants generally fund more basic research, and these researchers cannot participate in the SBIR program in a significant way as long as they remain primarily employed at the research institution. Consequently, many potential commercial applications languish in the research laboratory and never see the light of day.

The result, as the M.I.T. Commission on Industrial Productivity has noted, is that "the scale of the [U.S.] scientific enterprise is unequaled, and [the United States] is second to none in making new discoveries. Yet U.S. companies increasingly find themselves lagging behind their foreign rivals in the commercial exploitation of inventions and discoveries."

Early evidence suggests that STTR offers a promising solution to this problem. A January 1996 GAO study of the STTR program reached the following conclusion:

> "In general, technical evaluations of STTR proposals showed favorable views of the quality of proposed research and commercial potential. For research quality, the evaluations (1) awarded perfect scores to many proposals, (2) rated proposals among the top 10 percent of research in certain agencies, (3) described some proposals as "cutting edge," and (4) generally found the quality to be excellent. For commercial potential, the evaluations arrived at similarly favorable conclusions, although in some cases they were somewhat more cautious because of the newness of the program or the risk associated with the proposals."

To complement the GAO findings, last month DoD conducted an informal survey of 25 small companies and research institutions that participate in the DoD STTR program. We asked them why they chose to participate in the STTR and whether, in their experience, the STTR program serves a different function than the SBIR program. The responses suggest that STTR is serving its intended purpose. What follows are some illustrative responses:

Prof. Rama Chellappa, University of Maryland, collaborating with HNC Software, Inc. of San Diego, CA and LNK, Inc. of Silver Spring, MD:

Professor Chellappa has participated in both the SBIR and STTR programs, and finds that the two programs serve very different functions. In STTR, he does research in support of the project, taking the state of the art in the university and moving it to industry quickly -- in six months or so. In SBIR, he's hired as a consultant to the small company, and generally works on technologies that are already more well-developed. Professor Chellappa describes STTR as a technology transition program in a hurry; it is focused and can happen. Without STTR, the technology transfer, if it occurs, would occur by serendipity, and would take much longer.

Fai Mok Holoplex, Inc., Pasadena, CA, collaborating with Jet Propulsion Laboratory:

The technology that Holoplex is developing under STTR originated in part with a Jet Propulsion Laboratory (JPL) invention. STTR is a very good vehicle for working with JPL because, for the technology to be developed and ultimately commercialized, JPL must still do the more basic research on the project. STTR taps into something different than SBIR -- it gives a direct, practical channel for technology transfer.

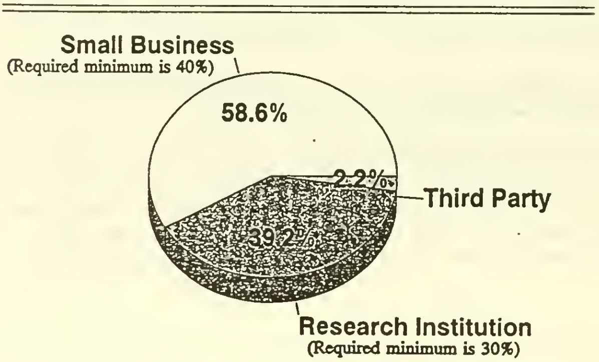
Ed Fickensher, Director, Office of Technology Management, Washington University, St. Louis:

For university-developed technology, STTR is by far the preferred route. In STTR, the university researcher can develop his or her own invention, working with a small business. In SBIR, the university assists (e.g., in a consulting role) in the development of a small business' technology. STTR makes an immense difference to a university professor who's an entrepreneur but finds it unfeasible or undesirable to leave the university to start a small business.

I also note that although STTR involves the significant participation of research institutions, it is still very much a small business program. In each STTR project, the small business is the prime contractor, and, on average, the small business performs slightly more than half of the work on the project, as shown in the first chart below. The other chart profiles the types of research institutions that participate in the program.

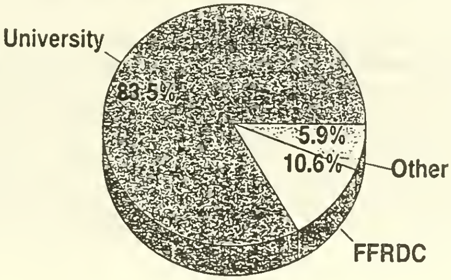
DoD STTR

Workload Breakout



DoD STTR

Research Institute Partners



STTR is a new and highly promising program, and DoD supports its continuation. We will evaluate the STTR program as it develops, to determine whether the program continues to serve its intended purpose. It may also be helpful for Congress to ask GAO to conduct a systematic evaluation of STTR within the next few years.

DoD's Recent Efforts to Streamline and Improve its SBIR and STTR Programs

DoD has been pleased with the success of its SBIR and STTR programs, but we have also taken important steps to streamline and improve these programs in response to this Committee's recommendations in the 1992 SBIR and STTR Act. In particular, this Committee expressed concerns about reducing unnecessary delays in the SBIR contracting and payment process, and about increasing the focus of the SBIR program on commercialization of the research.

In June of last year, Under Secretary of Defense for Acquisition and Technology Dr. Paul Kaminski approved a number of recommendations designed to streamline and improve the SBIR and STTR programs so that they better serve the needs of both small businesses and DoD. The recommendations were developed by a DoD Process Action Team comprised of representatives from the Military Departments, the Defense Agencies, and the Office of Secretary of Defense. The Team's recommendations incorporated significant input from the small business community.

The first set of recommendations was designed to reduce delays in the SBIR/STTR proposal evaluation, contracting, and payment process. For instance, at the end of FY 1995, each of the component SBIR and STTR programs within DOD developed and began implementing a plan to reduce the time between proposal receipt and award by about 30 percent (to 4 months in phase I and 6 months in phase II). We are closely monitoring the progress of the component programs in meeting these targets, and will report semi-annually on the components' progress to Under Secretary Kaminski.

The second set of recommendations was designed to increase commercialization of SBIR and STTR research in military and private sector markets. For example, on a pilot basis, DoD has established a high-priority, fast-track process for SBIR and STTR projects that are able to attract third-party investors during the second phase of SBIR. Furthermore, all companies submitting second-phase SBIR and STTR proposals are now asked to discuss the specific elements of their strategy for moving their technology rapidly from the R&D stage into widespread commercial use -- including military and/or private sector markets.

The third set of recommendations was designed to strengthen program outreach, as well as communication between small companies and their DoD customers. For instance, this past fall, the DOD SBIR/STTR program began "pre-releasing" its solicitation topics, along with the names and phone numbers of the topic authors, before the official opening of each SBIR or STTR solicitation. This pre-release enables small companies to talk directly by telephone with the topic authors -- their DoD "customers." Small businesses strongly favor this new pre-release policy because it enables them to get a better sense of the needs of their DoD customer before they invest the time and energy to write an SBIR or STTR proposal. DoD also benefits because the new policy results in higher-quality SBIR proposals and fewer misguided proposals.

Conclusion

In conclusion, DoD is pleased to report that our SBIR program is effectively harnessing the innovative talents of our nation's small technology companies for the benefit the U.S. economy and the U.S. military. Furthermore, we find evidence that the new STTR program effectively taps a different, and potentially vast, reservoir of technical ideas in our research institutions. Finally, we are making a serious effort to streamline and improve our SBIR and STTR programs, so that they can better serve the needs of both small businesses and the Department of Defense.

Thank you.

SBIR Program Successes

Integrated Systems, Inc.

Integrated Systems of Santa Clara, California conducted two of the most commercially-successful DOD SBIR projects, as identified by the 1992 GAO study. The SBIR projects involved the development of technology for the efficient writing of embedded software, including software for a robot to load munitions, which had important spin-offs in the automobile industry. Cumulative sales revenues to date from the SBIR-developed technology exceed $100 million, about 15 to 20 percent of which are from sales to DOD or prime contractors. All of the software for the DC-X experimental launch vehicle developed by McDonnell Douglas used Integrated Systems' technology. McDonnell Douglas has said that if it had not used that technology, the software would have cost two times as much to develop, and taken two to three times as long. DC-X was the first launch vehicle project in which software was developed ahead of hardware and within schedule and budget.

II-VI, Inc.

II-VI of Saxonburg, Pennsylvania developed a process, under a DOD SBIR contract, which substantially reduced the defects in optical coatings used with high-energy lasers. The technology was so successful that it was commercialized during phase II and was in full operation by the end of phase II. Since 1988, the technology has generated roughly $30 million in revenue from sales, 20-30 percent of which have been to DOD or defense contractors -- including Hughes Aircraft, Raytheon, Martin-Marietta, Texas Instruments, and Westinghouse -- and the rest to private sector customers.

Advanced Technology Materials, Inc. (ATMI)

ATMI of Danbury, Connecticut has leveraged several SBIR awards to grow from 4 employees in 1987 with no revenues to 120 employees today and $20 million in annual revenues. Two-thirds of those revenues are from commercial markets; one-third are from DOD or defense contractors. Among its SBIR successes, ATMI has commercialized the results of an SBIR project with BMDO that allowed the fabrication of a device to deliver ultra-pure materials to semiconductor thin film reactors. The device is used in Navy laboratories to prepare ultra-sensitive infrared sensors, and by Intel, Motorola, AT&T, and IBM in their semiconductor plants around the world.

Irvine Sensors Corporation

Irvine Sensors Corporation, Inc. of Irvine, California, developed a chip stacking technology, using funding from NASA's SBIR program and a small contract from the Air Force. The technology enables 4-8 computer or memory chips to be glued into a small stack in the footprint of a single chip. After phase II, IBM and Irvine Sensors invested over $20 million to develop the technology into a manufacturable product. Total sales this year are expected to be $5-6 million, about half of which will be to DOD or defense contractors and half will be to private sector customers. Sales are expected to increase significantly in subsequent years.

Vista Controls Corporation

Vista Controls Corporation of Valencia, California developed an advanced electronic computing card through the SBIR program, which is used in military tanks, helicopters, and training and simulation systems, as well as commercial vehicles such as railroads. Cumulative sales to DOD customers -- including the Army, Air Force, and Marines through such prime contractors as United Defense, General Dynamics and Lockheed -- total approximately $20 million. Cumulative sales to private sector customers, including Union Switch and Signal, total about $5 million.

Power Spectra, Inc.

Under a DOD SBIR contract, Power Spectra of Sunnyvale, California developed and tested a bulk avalanche semiconductor switch activated by a laser. The switch can deliver 15 kilovolts in less than a nanosecond and can achieve this in excess of a billion times during its life. Boeing Corp. was the principal source of financing after phase II, supplying $21 million since 1989 for the development of the technology into a product with broad commercial and military applications -- primarily ultrawide band radars for foliage and earth penetration. The technology has since become classified, and the primary customer is the military electronic warfare community. Cumulative sales revenues from the switch are roughly $11-12 million -- $9 million to DOD and $2-3 million to the private sector.

KMS Advanced Products, Inc.

Under a DOD SBIR contract, KMS of Ann Arbor, Michigan developed a ruggedized computer for use in harsh environments, using off-the-shelf components. It sold the technology to NAI Technologies in Woodbury, New York, which currently manufactures the ruggedized computer and sells it, almost exclusively, to military customers in the United States and abroad. Cumulative sales to date total $30 million, roughly $22-23 million of which have been to DOD or its prime contractors.

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STATEMENT OF
ROBERT M. PAP
PRESIDENT & CEO
OF
ACCURATE AUTOMATION CORPORATION

BEFORE THE COMMITTEE ON SMALL BUSINESS
U.S. HOUSE OF REPRESENTATIVES
ON THE
SMALL BUSINESS INNOVATION & TECHNOLOGY TRANSFER RESEARCH
MARCH 14, 1996

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Mr. Chairman and members of the committee, it is my pleasure to present this statement about our experience and knowledge of the Small Business Innovation Research and Small Business Technology Transfer Research programs. Hopefully, this will allow the Congress to develop legislation to help meet the proposed technology needs for the America of the next millennia. As a result of this committee's efforts, the American people have a very successful government program in the Small Business Innovation Research (SBIR) and the Small Business Technology Transfer Research (STTR) areas that are meeting or exceeding all of the objectives stated in the original legislation. The SBIR program became law in 1982 and was reauthorized in 1986 and 1992. It is a crown jewel in the government's efforts to keep America technologically competitive in the 1990s. As part of Public Law 102-564 a new and vital program known as Small Business Technology Transfer Research was developed by this committee working with the Science and Defense Committees of the House. The efforts have given us a program that allows the National Labs, FFRDCs and University Community to better interact with the small business community.

Today the SBIR and STTR programs provide 12% of all the venture and seed capital in the United States. In terms of the early stage seed capital required for R&D, the SBIR and STTR programs actually fund over $1,000,000,000. compared to the private capital market that provides $300,000,000. needed capital for the early startups. The venture capital market does not have the money, nor are they able to provide this high risk seed funding needed today. Not only is this capital vital to successful American R&D, it is needed to provide job creation in a time of large corporate America downsizing. The actual intellectual interaction with some of the top researchers, as a result of the SBIR and STTR in this early stage funding, is allowing startup businesses like mine to survive, prosper and grow into the successful IPOs we see going public. A significant number of the successful technology IPOs, including some of the top ten IPOs last year, had SBIR funding.

I am the President and Chief Executive Officer of Accurate Automation Corporation of Chattanooga, Tennessee, a company that has been doing advanced research under the SBIR program since 1988. I was a delegate to the 1995 White House Conference on Small Business where I was the technology chairman from Tennessee. Accurate Automation was fortunate to win one of the first STTRs from the Department of Defense, Navy, with both a Phase I and Phase II award. I have firsthand experience and knowledge on the performance of this act, its benefits, its people, agencies, and the progress of this very important program. I hope that the information I supply will provide you with a better knowledge of our experience under the Small Business Technology Transfer Research program as defined in 15 USC 638 and Public Law 102-564 Title II.

I testified about this legislation before this committee on November 6th, 1991, and the House Science Committee on March 23rd, 1993. It is a true privilege to have witnessed American Democracy and the Congress develop HR-4400 into S 2941 which then became the Public Law 102-564 in a bipartisan and unanimous form. The legislation, especially STTR, is more than we expected and is a true opportunity for bringing the University, National Labs, FFRDC and small businesses together to form a very powerful force to drive the American economy into the 21st Century.

The STTR does a number of things that SBIR does not and it allows room for greater basic discoveries in the future. We still need SBIR as it is formulated. The STTR program can solve a number of the problems that divide the research community. The young University faculty member can be a Principal Investigator with the individual who is charged with the commercialization. The STTR allows the small business to access technology that is in the National Labs or FFRDCs today. The only way this technology can get into commercial use is for the information to be published for all the world to see and exploit before small business can get at it. STTR provides the technology maturation for our country to benefit from our research investment. In a recent trip to the far east, I heard that the head of the computer science and engineering department of the Chinese University of Hong Kong referred to STTR as unfair to the rest of the world because the American entrepreneur could get products into production before the Asians could. He said that in my area of neural networks, we have prevented them from creating new needed jobs like they had in the area of Fuzzy Logic.

ACCURATE AUTOMATION BACKGROUND

Accurate Automation is a computer systems house doing research & development in the emerging computational technology of neural networks as well as hypersonic aircraft design. We have received 30 SBIR Phase I awards and 17 SBIR Phase II awards to-date. In addition, we have had fourteen Phase IIIs worth over $2,000,000. to date. We have commercialized our neural network technology through high performance computer boards and licenses that are shipped on personal computers, aircraft avionics, High Performance 3-D Workstations and Project Supercomputers. Over 150 technical papers and one book, to-date, have been written as a result of this funding. We are currently applying for patents on our technology.

Accurate Automation's 1995 sales (including the Phase IIIs) were nearly $5,000,000. Our Neural Network Toolbox will be shipped on over 10,000 high performance graphics workstations and project supercomputers. We had revenues of $188,000 in 1989, $470,000 in 1990, $880,000 in 1991, and $1,146,000 in 1992. With each payment by an agency to Accurate Automation, our associated payroll puts nearly 17% of revenue back into the U. S. Treasury almost immediately. The profit from our technology transfer bring more revenue back to the U. S. Treasury as we grow.

The SBIR program has allowed Accurate Automation to grow from a two-person company located in a 450 square foot office in the basement of a Sheraton Hotel in downtown Chattanooga in 1988. Today we have twenty-eight full time employees and five part-time employees occupying 10,000 square feet of a 21,000 square foot facility.

Our SBIR and STTR neural network projects are very innovative and they contribute to keeping the United States ahead of Japan and Europe in this important technology. These projects have led to the development of the Neural Network Processor which is the only

Multiple Instruction/Multiple Data or MIMD Neural Net hardware on the market. Our Neural Network Toolbox is a library of neural network tools that will compete as a world class product. (Our competition is from the French and English under the ECC ESPRIT government program.) Under the Office of Naval Research STTR, we are now designing a sensor fusion computer printed circuit board for improving the performance of workstations and signal processing hardware. We expect to have the first one installed in less than eight months. There is a large market for this product. We will be the only sensor fusion chip in the IC Master Directory.

The neural network technology being developed at Accurate Automation Corporation is directly related to the Critical Technology Plan, as reported to the Congress by the Department of Defense and Department of Commerce. Without the SBIR program, our technical success and growth as a company would not have taken place.

TECHNOLOGY TRANSFER AT ITS BEST

The new STTR law allowed Accurate Automation to have a Ph D Physical Chemist collaborate with a Biologist at Wake Forest University to develop a revolutionary technology. It is based upon basic research on how animals, such as cats, produce sensor fusion. We are now able to create a new technology for sensor fusion based on insights gained from biological research. As a result, we have a breakthrough technology that will allow Accurate Automation to field the first sensor fusion integrated circuit (computer chip) for this critical technology.

The new STTR worked here and would not work under the SBIR law because it had two principal investigators, one from each organization The nature of the STTR program allow each organization to contribute most effectively in their normal research environment. Under SBIR this would not be possible. The SBIR should not be changed because the creative nature of that program would be diminished under the STTR rules Each program has unique and significant advantages to the productivity of the research and technology implementation potential. Our experience has shown that both methods SBIR and STTR do not complete, but compliment each other. This will maximize the commercial potential of research and development for the next millennia.

Sharing the benefits of the commercialization will be done by Accurate Automation donating a part of the profits for the researcher to fund future American graduate students in their departments. This will develop more American rather than foreign graduate students.

CRADA EXPERIENCE

We have formed relationships with Tennessee State University and the CESAR Lab from Oak Ridge National Labs. We are interested in having CESAR assist us in helping take robotic technology out of the lab and commercializing it. We have prepared a Cooperative Research and Development Agreement (CRADA) request, but it is very difficult when the investment capital is not available. The problem is the lack of money to support the research in developing the products, and also, the overhead of the DOE Labs is prohibitively high.

SBIR PROJECT EXPERIENCE

Accurate Automation's experience in the SBIR program includes dealing with the Navy for advanced air traffic control systems. This was our first SBIR and responded to a requirement from the Naval Air System Command (PMA-213). It was our first SBIR Phase II. This project was managed by the then Naval Ocean Systems Center (now NRaD) in San Diego, CA. This project lead to a new technology for reducing radar clutter and processing data from multiple sensors on an aircraft carrier or amphibious assault ship. We have had a Phase III effort for the Navy as a result. We also have had a contract with the Federal Aviation Administration to work with air traffic control. This technology provides new signal processing and data collection technology.

Accurate Automation has received a number of Phase II SBIRs from NASA Langley Research Center, the Air Force Wright Labs and the Office of Naval Research, to fund the development of a hypersonic aircraft known as a "Waverider" under a program called "LoFLYTE" for Low Observable Flight Test Experiment. This project will provide revolutionary flight controls for all types of aircraft. We are developing an advanced air data subsystem for all types of aircraft. This program has been covered by *Aviation Week*, *Popular Mechanics*, *Avionics Magazine*, *New Technology Week* and even the *London Sunday Times*. This SBIR program also has given us the opportunity to provide innovations in hypersonics and return to the United States to its rightful stature and may help stop the constant drain of our technology and eventually help to correct our balance of trade deficit.

NEURAL NETWORKS

The SBIR programs in the various agencies have funded a number of researchers in the area of neural networks. The Europeans and Japanese research communities have been investing heavily to catch up with the United States. If it were not for the SBIR investment in neural network technology to fulfill a variety of needs, as outlined by the people in DoE, DoD, NSF, DOT, and NIH, they would probably have caught up with our country already. The Europeans are outspending the United States, if the SBIR investment are not included in the totals. In addition, the SBIR program is driving companies like Accurate Automation to commercialize the results of the research and getting us out in the marketplace fast and ahead of the rest of the world.

OTHER BENEFITS

Because of the STTR and SBIR, we see the academic professors wanting to work with small firms in many areas of innovation and thus developing commercialization of government funded research. This same concept can be expanded to the researchers and scientists in the national labs under the STTR program. It is because of the SBIR program design, the quality of the solicitation topics, and the real-world problems that the SBIR program addresses that we have job creation and new technology development.

One sector that needs to participate in the SBIR and future STTR programs is the federal laboratories. It would be useful to allow the federal labs to be a major STTR component much like the universities now. This will directly facilitate "TECH TRANSFER" from the labs to be commercialized in addition to the present methods. I believe that small high technology firms and the SBIR/STTR program in particular, represent the nation's most effective technology transfer mechanisms. The best way to do this is to have combined solicitation for only federal employees to work with small business under the National Science Board direction. This would be very significant to our economy.

The only problem I have seen in the present solicitation is that the DoE owned National Labs will not enter into the same commercialization agreement that is provided in the DoE Solicitation. The purpose of the agreement is not to strangle the small business but to share with the researcher at the National Lab. I believe that it is not in the national interest for the profits from the technology to be taken away and denying funds for marketing and sales. The taxpayers are actually rewarded by the taxes generated by the STTR and not the pittance collected by the National Lab. This problem from DoE needs to be addressed.

CONCLUSIONS

Accurate Automation has followed the intent of the SMALL BUSINESS INNOVATION RESEARCH SMALL BUSINESS TECHNOLOGY TRANSFER RESEARCH PROGRAM in

Public Law 102-564. We have developed new technology in an exciting new field, grown as a company and commercialized government research through the development of Phase III licenses. The National Labs have been an important part of our success, as has the university community.

In an era of corporate downsizing and less investment in research by major corporations, the SBIR and STTR program provides jobs, ideas, innovations, new product, and has stimulated the economy in a way that cannot be found in most major corporations. Accurate Automation's growth, and that of other SBIR and STTR companies, which far exceed ours, is testimony to this. With the research and development tax law revision in the late 1980s and the current lack of early seed capital, the opportunity for venture capital and support for technological development has all but dried up in America. Your insight in 1982, 1986 and 1992 in the creation and renewal of the Small Business Innovation Development Act has become vital to American innovation which is now centered in small high technology businesses like Accurate Automation Corporation. Our location in Tennessee is proof that ingenuity and creativity can be fostered instates other than the traditional centers of high technology.

Through our participation in the SBIR and STTR programs and by developing these arrangements with National Labs as well as academia and in Phase III commercialization, we have done our part to circumvent the all too well known scenario of being invented in America, but commercialized by the Japanese, Asians or Europeans. This is Accurate Automation's effort to fulfill the SBIR and STTR mandate to be a "counterforce to inflation and help reduce the United States balance-of-payments deficit" as stated by the original writers of this legislation.

RECOMMENDATIONS

1. Extend the STTR law to match the SBIR law of 4 extra years. Increase the amount to 1% of the extramural research.

2. The (CRADA) does not work for small businesses. This program needs to be carefully crafted to consider the effects on the rates and audits from the government agencies related to the small businesses The amount of paper work and bureaucracy needs to be reduced for the good of the program. The question of how does this affect my rates from DoD and NSF needs to be resolved. Small businesses do not have the money or legal advisors to develop CRADA. There is very little venture funding so SBIR is becoming the primary means of funding innovative research and commercialization today This does not necessarily require that the amount be money, but a commitment to commercialize and create jobs needs to be evident. The Congress might allow a CRADA to become an option at the end of an SBIR/ STTR Phase I or Phase II awards, with the agreement of both the SBIR company and the sponsoring agency.

3. Encourage the National Lab to show how they can parley the SBIR/STTR products to be commercialized into dual use technology and become real American made products. STTR firms with Phase II awards should be able to play a key role in commercialization of the results. Obviously, a National Lab that does good research, needs to learn how to be competitive in the world of tomorrow. This will allow important national problems to be addressed and technology developed.

4. Have the National Labs allow scientists and researchers to have sabbaticals working on a project with a business, or in teaching at a University under STTR. This should be done instead of paying the people to retire. The individual initially would be funded by the agency, with a report to the Congress each year on what they are doing to improve American society. These scientists and researchers would then become a reserve technology pool . The immediate benefit is that the overhead of support is cut from the DOE budget. They would then report on the progress of their research project. They could help advance an SBIR/STTR project they see potential in, or could teach at a non-major research university. This would be similar to our experience with TSU. This sabbatical program would offer an opportunity to recognize and reward technological innovation and related entrepreneurial success for commercialization of government research and development. This keeps a farm system of researchers in case the peace dividend should not pan out and our troubled world needs these researchers back in government service.
5. The dedication of your federal scientists and researchers needs to be recognized and rewarded. I have worked with the National Science Foundation, the Department of Defense including Navy, Marines and Air Force, as well as the National Aeronautics and Space Administration. The commitment of these people makes our country the great country it is today. People like Roland Tibbits and Robert Wrenn will be missed by the High Technology Small Business community

I compliment this committee and the Congress on developing the SBIR and STTR programs. I want to thank you for your time and attention. I hope this information will help in extending the Small Business Technology Transfer Research Program..

Respectfully presented this the 14th day of March, 1996.

Robert M. Pap

Robert M. Pap
President,
Accurate Automation Corporation

HOUSE OF REPRESENTATIVES, U. S.
COMMITTEE ON SMALL BUSINESS
MARCH 6, 1996 10:00 A. M.

STATEMENT SUBMITTED BY MILTON D. STEWART
PRESIDENT, SMALL BUSINESS HIGH TECHNOLOGY INSTITUTE
CO-CHAIRMAN, REGIONAL COUNCIL FOR PROJECT SBIR WEST*

A. RECOMMENDATION: "Extend the STTR Pilot Program".

The Regional Council for Project SBIR West consists of volunteer technology specialists from 14 States (AZ,CO,ID,IA, MN,MT,NE,ND,NM,OR,SD,UT,WA & WY). It includes both SBIR/STTR competitors and facilitators.

More than forty members of the Council met in Salt Lake City on October 29, 1995. The STTR program was not on the agenda. But during one of the discussion sessions, a Council Member brought it up for discussion. Few of those present were engaged in an STTR program, but there was enough interest to precipitate a lively discussion.

At its conclusion, a motion was made and carried unanimously to record the Council's support for a reasonable extension of the STTR Pilot Program, and "reasonable" was defined to be extending so that the expiration date of the STTR program would be the next expiration date of the SBIR program.

Formerly Chief Counsel for Advocacy, U. S. Small Business Administration
Editor, INC Magazine
President, National Small Business Association
President, National Association of SBICs.

The dominant reason given in the discussion was the impossibility of making even a tentative evaluation of the program because of the brevity of the pilot. The extended period would provide a better opportunity for an evaluation of a number of issues. Among them should be whether the STTR's terms and conditions are likely to produce significantly different results than the SBIR program. No specific financing level was suggested, other than enough to fund Phases I and II adequately in the remaining years to provide an adequate basis for a final judgment, with no funding from the SBIR program itself.

B. The SBIR Program and This Committee.

It is more than twenty years since the SBIR program was born in a tiny NSF set-aside mandated by the Congress in the Kennedy - Heckler Amendment. The steady growth of the program since then has been the result of a healthy interaction between technology entrepreneurs and the small business community on the one hand and the Congress on the other.

Step by step, the program has grown from an initial 400 competitive proposals in the first year to NSF to about 25,000 to all SBIR agencies. No Federal program has been nurtered and watched more closely and appraised repeatedly by the General Accounting Office

The Chairman, the Committee and its staff are to be commended for broadening this hearing to include an oversight review of the SBIR program even though the sole immediate legislative question is apparently the STTR program. This is consistent with this Committee's patient and alert attitude of trusteeship about the

SBIR program. Enough competent testimony has been scheduled so that I wish to limit my comments to some bottom-line conclusions and reminders, for the benefit particularly of the newest Members of the Committee. It has been my good fortune to be involved with the program throughout its life and to be able to view it from within as well as outside the Executive branch.

1. SBIR is in no sense, a Federal handout program. Each small business competitor makes a risk-laden investment in the cost of preparation of one or more proposals to one or more SBIR-managing agencies. A conservative estimate of that preparation cost is between $5,000 and $10,000 per proposal. At an average of $7500, per entry, 25,000 proposals equals a sizeable investment by the would-be competitors -- $187,500,000. Since only one in eight to one in ten will win even a Phase I award, the probability of a return is not very high.

   Whatever the true numbers are, they are high enough so that it is proper to view the SBIR program as a partnership enterprise, whose risk is being shared by technology entrepreneurs and taxpayers.

2. No other Federal technology program has the potential to contribute to as many national needs as the SBIR program.

   Taken together, all of the SBIR programs' topics add up to the whole gamut of competitive technologies which will mark our success or failure in the new global economy;

national defense, health and medicine, manufacturing efficiently, environmental protection, agriculture -- SBIR topics deal with all of them and every other technology that contributes to our standards of living and safety.

3. "Commercialization" of SBIR Results Is One -- But Only One -- Measure of SBIR Program Success.

Every SBIR proposal requires the small business to describe the most likely commercial application of a successful result of the research to be done. "Commercialization" is defined to include government application.

4. Beyond Commercialization, the SBIR Program Represents a Long-Term Investment at the "Jugular of Economic Growth and Technology Transition".

We have never as a nation, faced the combination of economic pressures presently before us. The end of the Cold War, corporate downsizing, a rolling revolution in technology, defense downsizing. The job creation mission of new and growing small companies is more demanding than ever.

Twenty years after the tiny beginning of the SBIR program, this new mix of heavier pressure has, if anything, raised the priority position of the SBIR program. The "jugular of economic growth" is likely to be the point at which technology innovation begins. Our national network of small, innovative technology companies is being steadily strenghtened by the SBIR program. The added institutional power that gives to our local, regional and national economies must not be overlooked in the years ahead. Congress showed prudence and foresight in providing for modest increases in the size of the SBIR program. Only one more mandated increase is provided. It is none to soon to consider whether the program's final size should be reconsidered again in the 2000 FY renewal.

If the Committee or its staff has specific issues on which my comments will be helpful, I will be happy to try to be responsive.

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